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United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Texas Agricultural
Experiment Station

Soil Survey of Johnson County Texas

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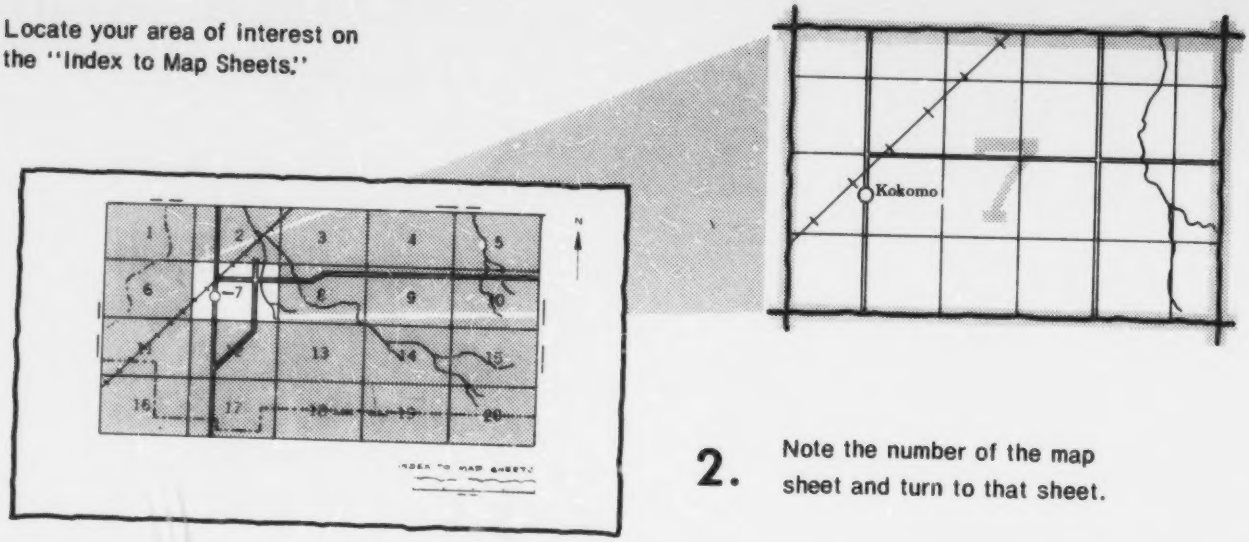
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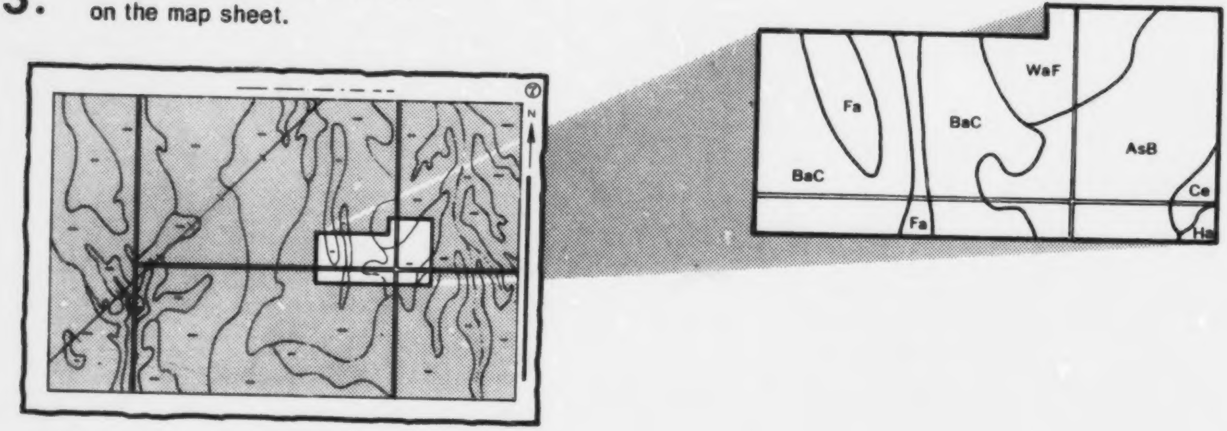
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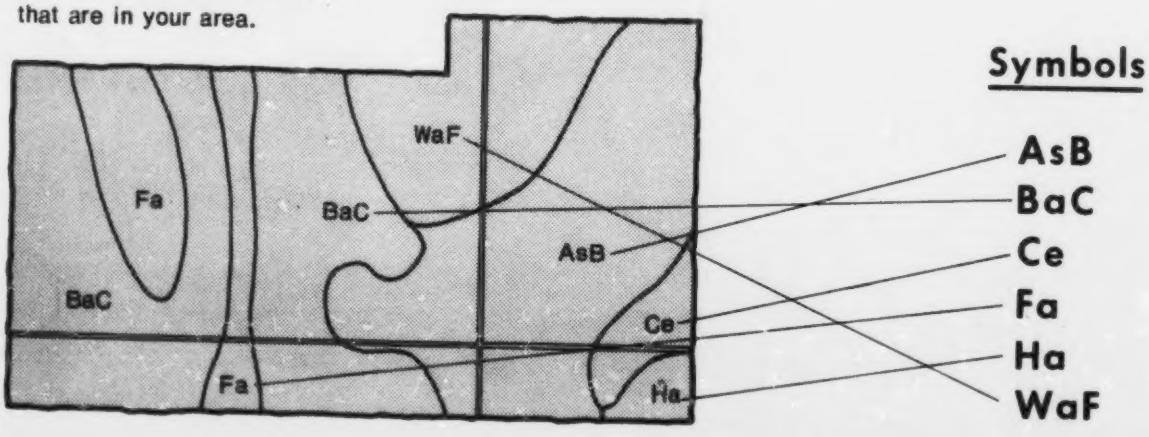
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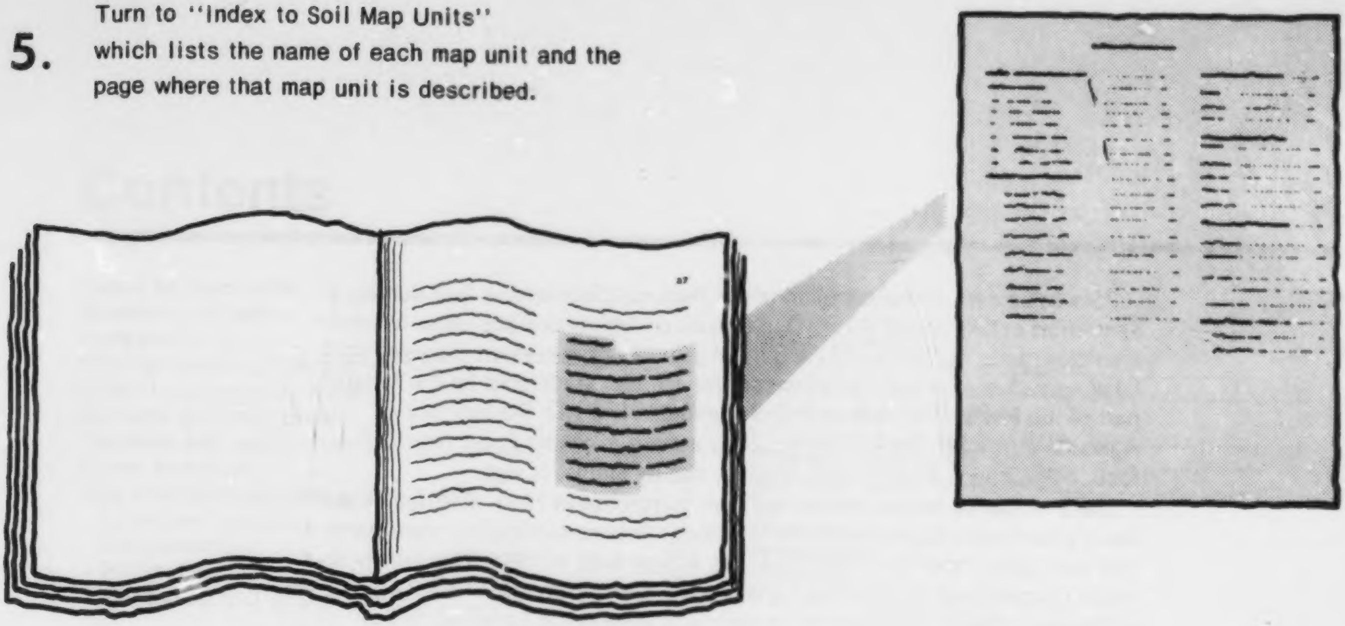
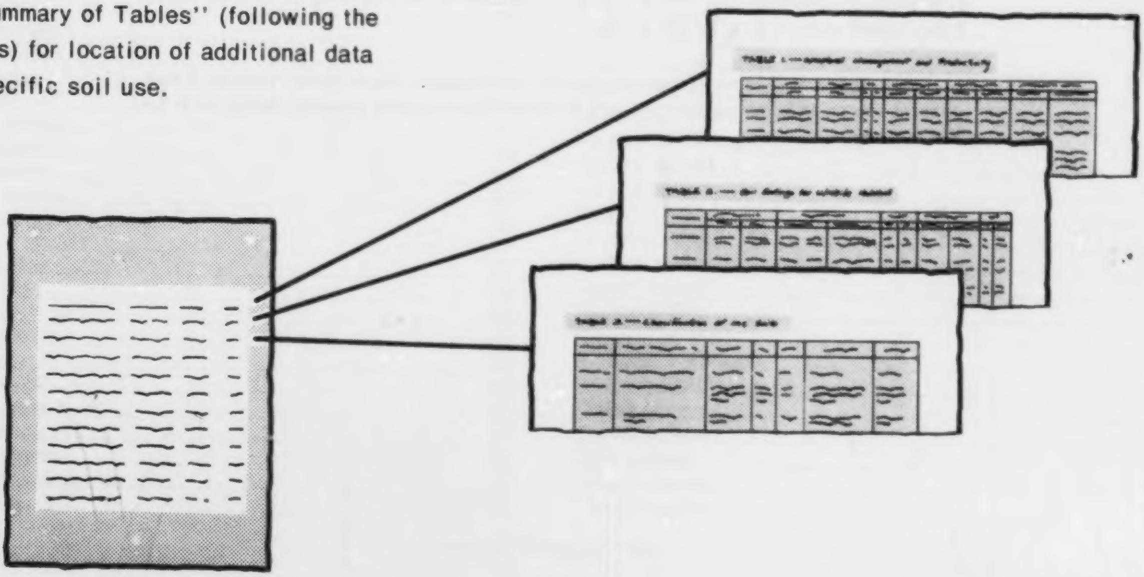
THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in 1981. Soil names and descriptions were approved in 1981. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1981. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Johnson County Soil and Water Conservation District and the Dalworth Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: About 25 percent of Johnson County is rangeland. Aledo-Bolar complex, 2 to 8 percent slopes, is in the foreground, and Brackett-Rock outcrop complex, steep, is in the background.

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Foreword

This soil survey contains information that can be used in land-planning programs in Johnson County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

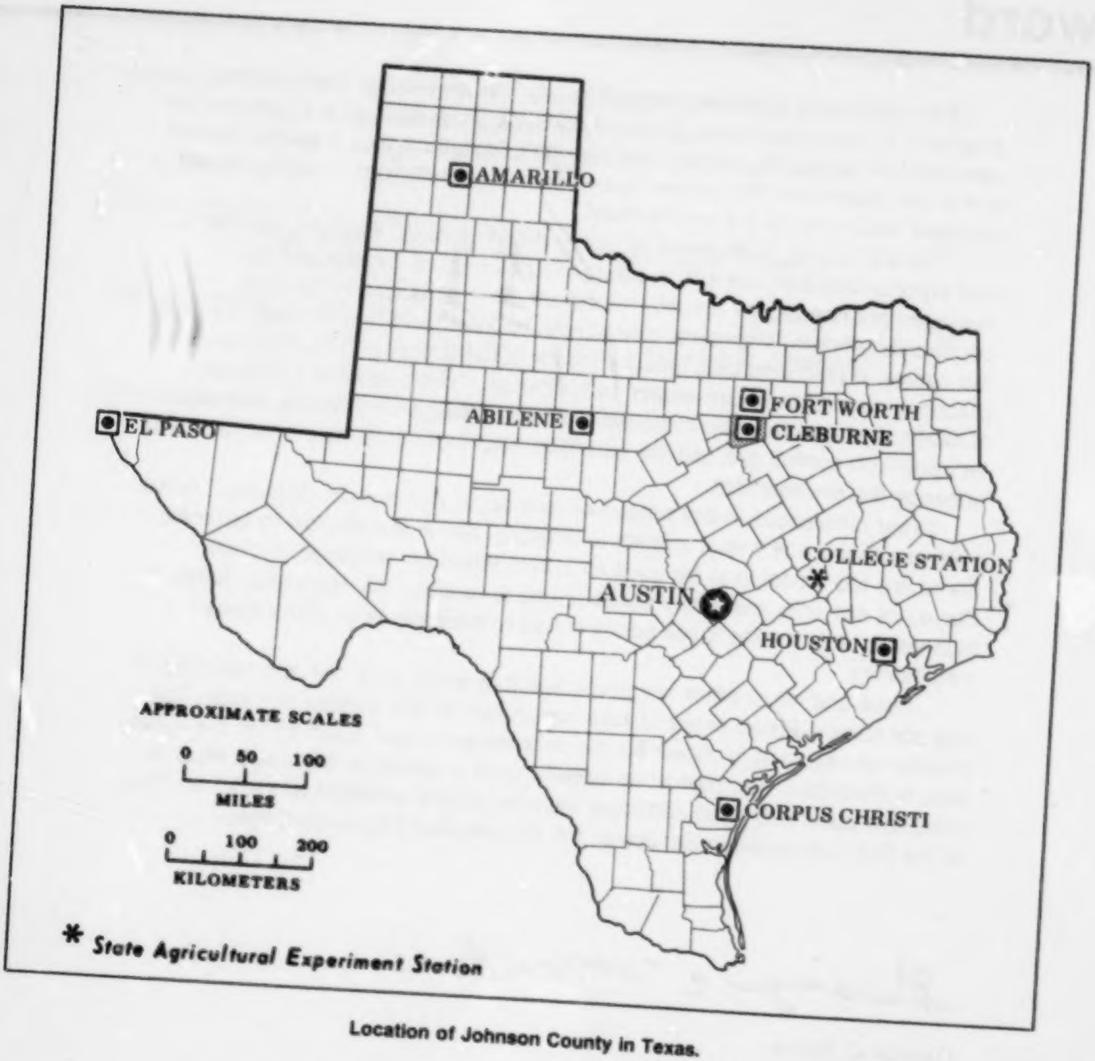
This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

George C Marks

George C. Marks
State Conservationist
Soil Conservation Service


AMARILLO
EL PASO
ABILENE
FORT WORTH
CLEBURNE
COLLEGE STATION
AUSTIN
HOUSTON
CORPUS CHRISTI
APPROXIMATE SCALES
0 50 100
MILES
0 100 200
KILOMETERS
* State Agricultural Experiment Station

Location of Johnson County in Texas.

Soil Survey of
Johnson County, Texas

By Winfred C. Coburn, Soil Conservation Service

Fieldwork by Winfred C. Coburn, Arthur R. Bauer, Paul E. Thomas, and Richard R. Zaborske,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with the Texas Agricultural Experiment Station

JOHNSON COUNTY is in the north-central part of the state. It has a total area of 473,600 acres, or 740 square miles, of which 2,233 acres are large bodies of water of 40 acres or more. The population of the county is increasing rapidly. According to the 1970 census, the population was 45,769; in 1980, it was 67,649. Cleburne, the county seat, in 1980 had a population of 19,218. Other towns in the survey area are Alvarado, Briaroaks, Burleson, Godley, Grandview, Joshua, Keene, Rio Vista, and Venus.

The topography is nearly level to hilly. Drainage of the northern and eastern parts of the county is by tributaries of the Trinity River and of the southern and western parts by those of the Brazos River. The elevation ranges from about 540 feet on the Chambers Creek flood plain to about 1,065 feet on Caddo Peak in the north-central part of the county.

Approximately 120,000 acres in the county is in rangeland, 155,000 acres in pasture, 179,000 acres in cropland, and 17,000 acres in urban and built-up land.

Johnson County is in the Grand Prairie, East Cross Timbers, and Blackland Prairie Land Resource Areas. Soils in the Grand Prairie area, which are dominantly dark-colored loamy and clayey soils, had native vegetation of mid and tall grasses. Soils in the East Cross Timbers area, which are dominantly light-colored loamy and sandy soils, had native vegetation of oaks and mid and tall grasses. Soils in the Blackland Prairie area, which are dominantly dark-colored and clayey, had native vegetation of mid and tall grasses.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

General Nature of the Survey Area

This section provides general information on the history, farming, and climate of Johnson County.

History

Jean Moss, president, Johnson County Chapter, Texas Historical Commission, helped prepare this section.

The Caddo Indians lived in the county and surrounding areas. In 1839 the first settlers built homes along Chambers Creek. During the 1850's other pioneer families settled along the Brazos River. In 1854 Johnson County was created from parts of Ellis, Hill, and Navarro Counties by an act of the Fifth Legislature and was named for Colonel Middleton T. Johnson, a famous Confederate soldier. Wardville became the first county seat. In 1867, the county seat was moved to a site then known as Camp Henderson; it was renamed Cleburne. The site of Wardville is covered by Lake Pat Cleburne. Between 1870 and 1880, railroads were built across the county giving rise to the population and economy.

Approximately 25 historical markers and sites are located throughout Johnson County. One of these is the Carnegie Building, built in 1904 in Cleburne; it is on the National Historical List. Another is Market Square, which has been designated by Johnson County officials as a central location for local farmers to sell their produce.

Farming

The early settlers along Chambers Creek found wood, water, and grass available, and the sandy soils could be plowed with their double shovels. Small acreages of truck crops and corn were planted for home use and each settler had a few livestock, mainly cattle. Because markets were far away, these early settlers were largely self-sustaining.

Following the Civil War two events brought rapid agricultural changes to the area—the opening of the Chisholm Trail that crossed the west side of the county and the invention of the moldboard plow. The Chisholm Trail was the main trail on which cattle were driven through central Texas from south Texas to Abilene, Kansas. Before the railroads, which were built in the area about 1876, thousands of cattle were herded up the trail yearly. The moldboard plow broke the sod for cultivated crops on large acreages in the Blackland Prairie and Grand Prairie Land Resource Areas. During these early years of farming, knowledge of practices to conserve the soil, such as returning crop residue to the soil, were neither known nor practiced. Erosion reduced much of the productivity of the land.

Efforts to solve the erosion problem resulted in the formation of the Nolan-Aquilla Soil and Water Conservation District in April 1944. In January 1971, landowners in the Johnson County part of the district, which included the southern two-thirds of the county, organized the Johnson County Soil and Water Conservation District. The northern third of the county is still within the Dalworth Soil and Water Conservation District, which was organized in May 1940.

Dairy herds provide the greatest source of income from livestock. Beef cattle income is primarily from cow-calf operations. Grain sorghum, cotton, wheat, and peanuts are the main crops in the county. Small acreages are in truck crops and orchards. Many acres that were cultivated have been converted to pasture.

Climate

Prepared by the National Climatic Center, Asheville, N.C.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Cleburne, Texas in the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 48° F, and the average daily minimum temperature is 36°. The lowest temperature on record, which occurred at Cleburne on February 2, 1951, is 0°. In summer the average temperature is 83°, and the average daily maximum temperature is 96°. The highest recorded temperature, which occurred at Cleburne on July 25, 1954, is 112°.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50° F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 32.27 inches. Of this, 19 inches, or 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 14 inches. The heaviest 1-day rainfall during the period of record was 8.28 inches at Cleburne on May 7, 1969. Thunderstorms occur on about 50 days each year, and most occur in spring.

The average seasonal snowfall is 2 inches. The greatest snow depth at any one time during the period of record was 11 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 80 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 12 miles per hour, in spring.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration. The pattern of damage is variable and spotty.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The soils in the survey area vary widely in their potential for major land uses. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, pasture, rangeland, urban uses,* and *recreation areas*. Cultivated crops are those commonly grown in the survey area. Pasture refers to pasture plants, such as improved bermudagrass, kleingrass, weeping lovegrass, vetch, and arrowleaf clover. Rangeland refers to land in native or introduced range plants. Urban uses include residential, commercial, and industrial sites. Recreation areas include campsites, picnic areas, playgrounds, paths and trails, and other areas that are subject to heavy foot traffic.

1. Crosstell-Gasil-Rader

Nearly level to sloping, deep, slightly acid loamy and sandy soils; on uplands

This map unit consists of moderately well drained to well drained soils that have slopes of 0 to 8 percent (fig. 1). The unit makes up about 28 percent of the county. It is about 52 percent Crosstell soils, 14 percent Gasil soils, 11 percent Rader soils, and 23 percent soils of minor extent.

The gently sloping and sloping Crosstell soils are on uplands. These soils are moderately well drained, and permeability is very slow. Typically, the surface layer is brown fine sandy loam about 5 inches thick. The subsoil extends to a depth of 51 inches. It is yellowish red clay that has yellowish and reddish mottles in the upper part; brownish yellow clay that has red mottles in the middle part; and coarsely and prominently mottled red, dark red, brownish yellow, yellowish brown, and light gray clay in the lower part. The underlying material to a depth of 76 inches is coarsely and prominently mottled light gray, gray, reddish yellow, yellowish red, and strong brown shaly clay.

The gently sloping to sloping Gasil soils are on uplands. These soils are well drained, and permeability is moderate. Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of 8 to 75 inches. It is brownish yellow sandy clay loam that has yellowish red mottles in the upper part and red and brownish yellow mottles in the middle part. It is coarsely and prominently mottled yellowish brown, red, light gray, and strong brown sandy clay loam in the lower part. In some places the surface layer is loamy fine sand, and reaction is neutral.

The nearly level to gently sloping Rader soils are on uplands. These soils are moderately well drained, and permeability is very slow. Typically, the surface layer is fine sandy loam about 16 inches thick. It is brown in the upper part, light yellowish brown in the middle part, and pale brown in the lower part. The subsoil to a depth of 27 inches is light yellowish brown sandy clay loam. To a depth of 72 inches, it is clay that is mottled throughout in shades of gray, yellow, and red and grades to sandy clay loam in the lower part.

Of minor extent in this unit are Birome, Coving, Gowen, Hassee, Navo, Ponder, Pulexas, Pursley, Rayex, and Silstid soils. The moderately deep and shallow, sloping to moderately steep, loamy Birome and Rayex soils are on uplands. The deep, nearly level to sloping, sandy Coving and Silstid soils are on uplands. The deep, nearly level, loamy Gowen, Pulexas, and Pursley soils are on flood plains of streams. The deep, nearly level to gently sloping, loamy Hassee, Navo, and Ponder soils are on uplands.

The soils in this unit are mainly used as rangeland and for pasture or urban development. These soils are moderately well suited to rangeland and pasture and well suited to use as habitat for wildlife. Yields of improved bermudagrass and native range grasses are fair. A small acreage of this unit is used for crops, mainly peanuts and forage sorghums. A few small areas of the soils are used for truck crops. Large-scale farming is limited by low natural fertility and rapid urban development. Gasil soils are well suited to orchards and nursery plants.

The soils in this unit are moderately suited to most urban uses. The shrinking and swelling of the soil with changes in moisture, the slow permeability, slope, and wetness are limitations, but they can be partly overcome by good design and installation. The soils are moderately well suited to most recreation uses. The post oak and blackjack oak on undisturbed areas of the soils make this unit desirable for residential use.

2. Aledo-Bolar

Gently sloping to strongly sloping, very shallow to moderately deep, moderately alkaline loamy soils; on uplands

This map unit is dominantly made up of well drained soils that have slopes of 1 to 12 percent (fig. 2). This unit makes up about 21 percent of the county. It is about 43 percent Aledo soils, 26 percent Bolar soils, and 31 percent soils of minor extent.

The gently sloping to strongly sloping Aledo soils are on ridgetops and on side slopes where they are mixed with narrow bands of Bolar soils. Aledo soils are well drained, and permeability is moderate. Typically, the surface layer is dark grayish brown clay loam about 5 inches thick. The next layer to a depth of 12 inches is grayish brown very gravelly clay loam. Coarsely fractured limestone is at a depth of 12 inches.

The gently sloping to strongly sloping Bolar soils are on side slopes where they are mixed with bands of Aledo soils. Bolar soils are well drained, and permeability is moderate. Typically, the surface layer is clay loam 12 inches thick. It is very dark grayish brown in the upper part and dark grayish brown in the lower part. The subsoil to a depth of 36 inches is clay loam that is grayish brown in the upper part and very pale brown in the lower part. The underlying material is fractured limestone interbedded with calcareous marl.

Of minor extent in this map unit are Brackett, Denton, Frio, Hensley, Krum, Lewisville, Lindale, Purves, Sanger, Seawillow, Slidell, and Sunev soils. On uplands adjacent to the Aledo and Bolar soils are the shallow, moderately steep to very steep, loamy Brackett soils; the moderately deep, gently sloping, clayey Denton soils; the shallow, gently sloping, loamy Hensley soils; the deep, nearly level to gently sloping, clayey Krum, Lewisville, Sanger, and Slidell soils; the moderately deep, gently sloping, loamy Lindale soils; and the shallow, gently sloping, clayey Purves soils. The deep, nearly level, clayey Frio soils are on flood plains of streams. The deep, gently sloping to strongly sloping, loamy Seawillow and Sunev soils are on colluvial foot slopes and stream terraces.

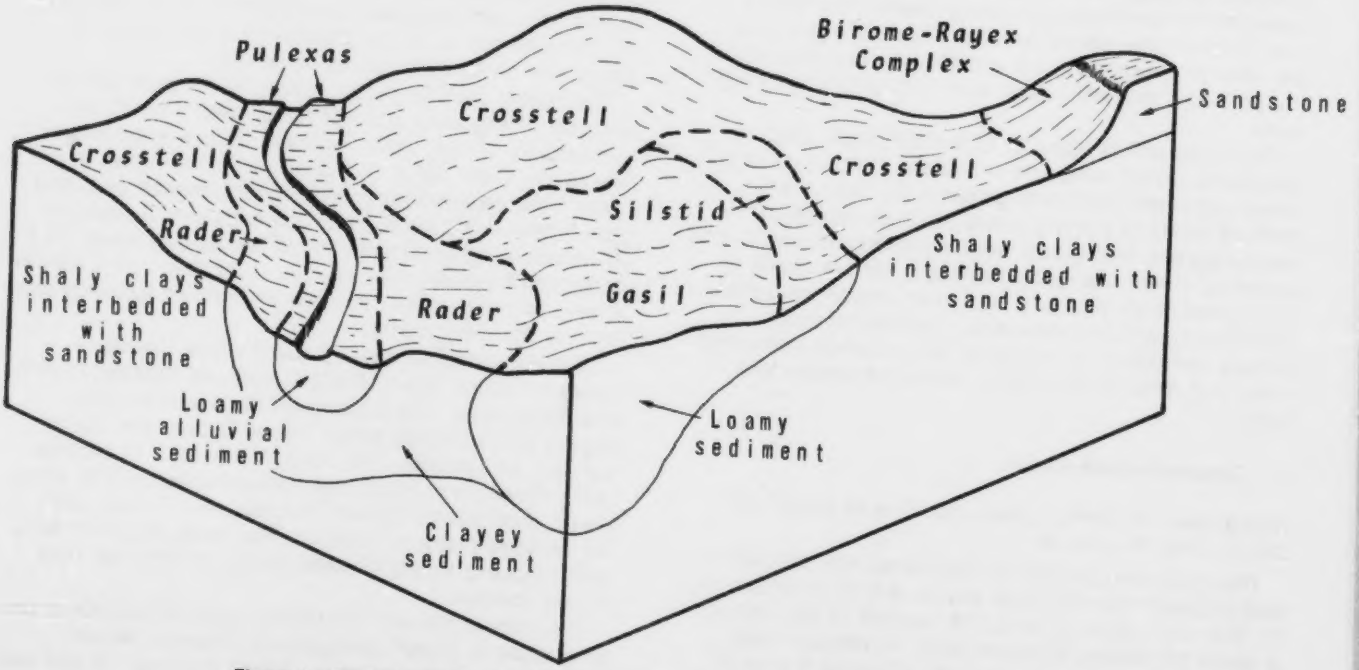


Figure 1.—Typical pattern of soils and parent material in the Crosstell-Gasil-Rader map unit.

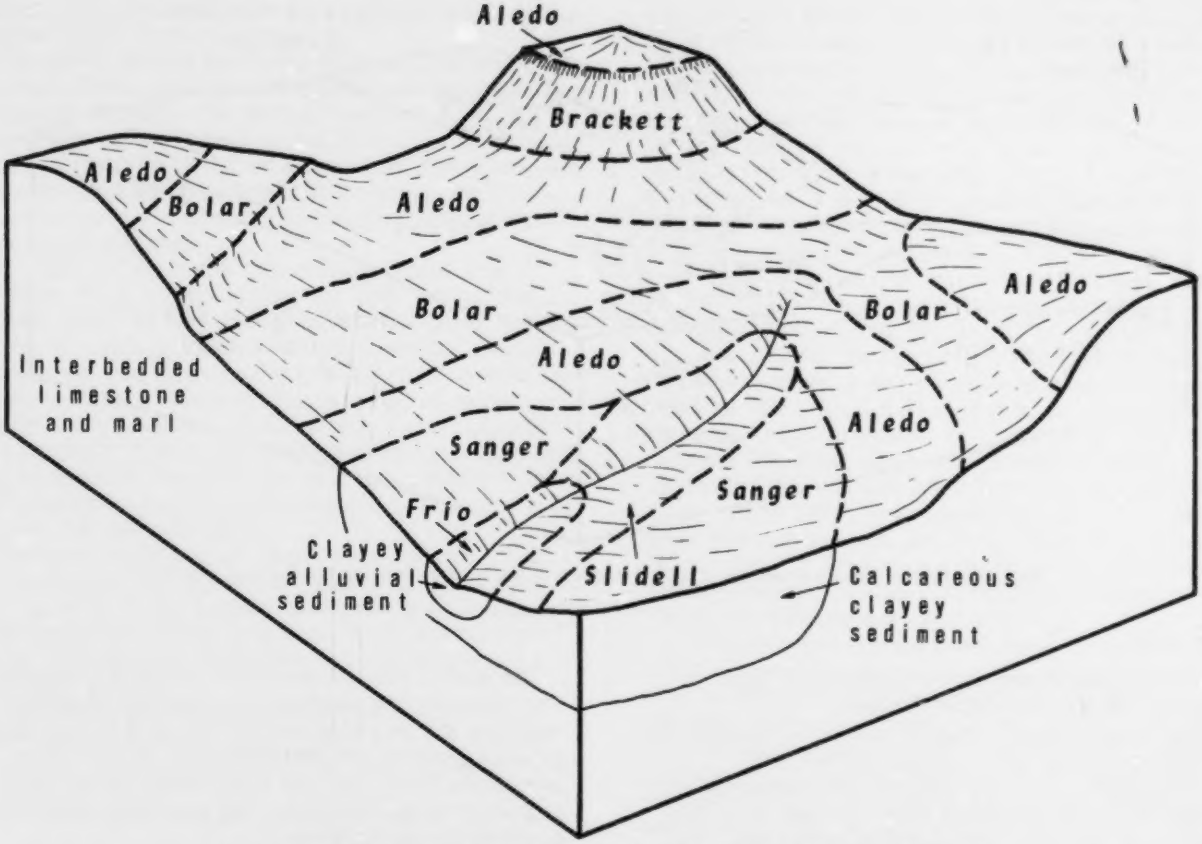


Figure 2.—Typical pattern of soils and parent material in the Aledo-Bolar map unit.

The soils in this unit are mainly used as rangeland. The soils are moderately well suited to rangeland. Native vegetation is mid and tall grasses and scattered live oak. These soils are moderately well suited to use as habitat for wildlife.

Generally, the soils in this unit are not suited to pasture and crops because of stoniness, slope, the very shallow root zone, and droughtiness.

The soils in this unit are poorly suited to most urban and recreational uses. Depth to rock, small stones, and slope are limitations that are difficult to overcome.

3. Heiden-Houston Black-Ferris

Nearly level to sloping, deep, moderately alkaline clayey soils; on uplands

This map unit is dominantly made up of well drained and moderately well drained soils that have slopes of 0 to 12 percent (fig. 3). This unit makes up about 19 percent of the county. It is about 71 percent Heiden soils, 12 percent Houston Black soils, 7 percent Ferris soils, and 10 percent soils of minor extent.

The gently sloping to sloping Heiden soils are on uplands. These soils are well drained, and permeability is very slow. Typically, these soils are clay to a depth of 62 inches. They are dark gray to very dark grayish brown in the upper part, dark grayish brown in the middle part, and grayish brown mottled with yellow in the lower part. The underlying material to a depth of 80 inches is light yellowish brown shaly clay that has grayish brown mottles.

The nearly level to gently sloping Houston Black soils are on broad uplands. These soils are moderately well drained, and permeability is very slow. Typically, these soils are clay to a depth of 80 inches or more. The surface layer is about 8 inches thick. It is very dark gray. The next layer to a depth of 34 inches is dark gray. The material below that is dark grayish brown grading to

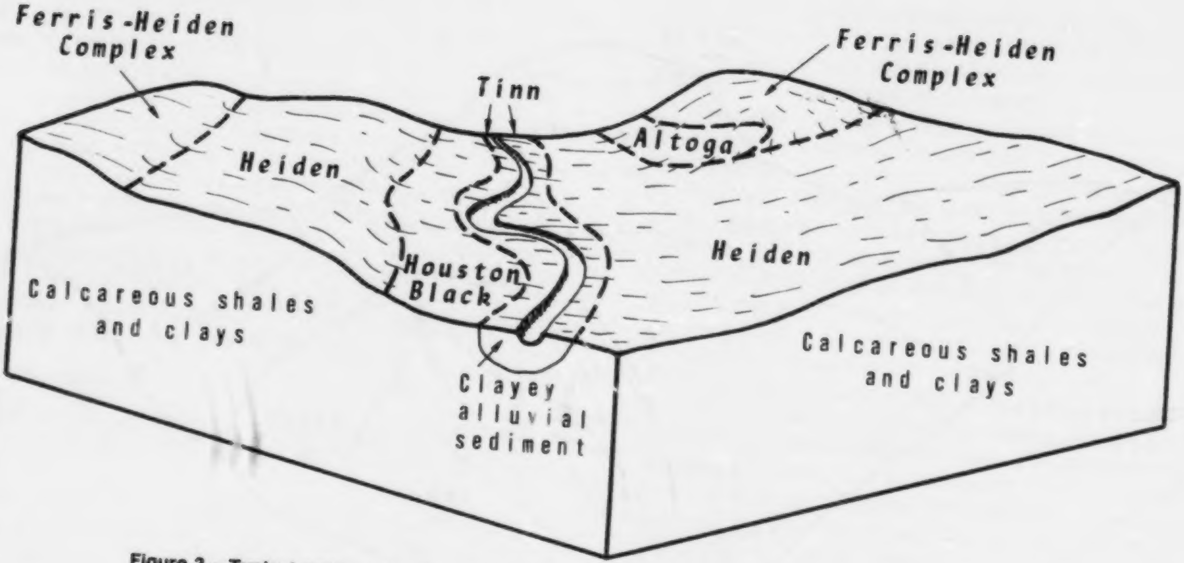


Figure 3.—Typical pattern of soils and parent material in the Heiden-Houston Black-Ferris map unit.

mottled grayish brown, dark grayish brown, light yellowish brown, and yellowish brown.

The gently sloping to strongly sloping Ferris soils are on uplands. These soils are well drained, and permeability is very slow. Typically, the surface layer is brown clay about 10 inches thick. The next layer to a depth of 45 inches is light yellowish brown clay. The underlying material to a depth of 60 inches is mottled light gray, brownish yellow, yellowish red, and dark yellowish brown shaly clay.

Of minor extent in this map unit are Altoga, Burleson, Culp, Gowen, Lewisville, Navo, Pursley, Seawillow, Tinn, and Wilson soils. The moderately deep, gently sloping, clayey Altoga soils are on uplands. The deep, nearly level to gently sloping, clayey Burleson and Lewisville soils are on uplands. The deep, nearly level to gently sloping, loamy Culp, Navo, and Wilson soils are on uplands. The deep, nearly level, loamy Gowen and Pursley soils are on flood plains of streams. The moderately deep, gently sloping to strongly sloping, loamy Seawillow soils are on upland foot slopes. The deep, nearly level, clayey Tinn soils are on flood plains of streams.

The soils in this unit are mainly used for crops. They are well suited to such cultivated crops as grain and forage sorghums, cotton, and small grains.

The soils in this unit are well suited to use as pasture and rangeland. Yields of improved bermudagrass and kleingrass are good. This unit is moderately well suited to use as habitat for wildlife.

The soils in this unit are poorly suited to urban uses. The shrinking and swelling of the soil with changes in moisture, the very slow permeability, and the corrosivity to uncoated steel are limitations that are difficult to overcome. These soils are moderately well suited to recreation uses. The clayey texture and the very slow permeability are limitations.

4. Sanger-Slidell-Bolar

Nearly level to sloping, moderately deep to deep, moderately alkaline clayey and loamy soils; on uplands

This map unit consists of well drained soils that have slopes of 0 to 8 percent. The unit makes up 12 percent of the county. It is about 43 percent Sanger soils, 18 percent Slidell soils, 12 percent Bolar soils, and 27 percent soils of minor extent.

The gently sloping Sanger soils are on uplands. These soils are well drained, and permeability is very slow. Typically, these soils are clay to a depth of 72 inches. The surface layer to a depth of about 37 inches is very dark grayish brown in the upper part and dark grayish brown in the lower part. The layer below that is brown to light yellowish brown. The underlying material to a depth of 80 inches is yellow shaly clay.

The nearly level to gently sloping Slidell soils are on uplands. These soils are well drained, and permeability is very slow. Typically, these soils are clay to a depth of 72 inches. They are very dark gray to dark gray in the upper part, grading to grayish brown and light brownish gray in the lower part. The underlying material to a depth of 80 inches or more is light brownish gray shaly clay that has yellowish and brownish mottles.

The gently sloping to sloping Bolar soils are on uplands. These soils are well drained, and permeability is moderate. Typically, the surface layer is dark grayish brown clay loam about 14 inches thick. The layer below that to a depth of 35 inches is clay loam that is brown in the upper part and pale brown in the lower part. The underlying material is fractured limestone interbedded with calcareous marl.

Of minor extent in this map unit are Aledo, Frio, Hensley, Krum, Lewisville, Lindale, Lott, Ponder, and Purves soils. The very shallow to shallow, gently sloping to strongly sloping, loamy Aledo and Hensley soils are on uplands. The deep, nearly level, clayey Frio soils are on flood plains of streams. The deep, gently sloping, clayey Krum, Lewisville, and Lott soils are on uplands. The moderately deep, gently sloping, loamy Lindale soils are on uplands. The deep, gently sloping, loamy Ponder soils are on uplands. The shallow, gently sloping, clayey Purves soils are on uplands.

The soils in this unit are used mainly for crops, but some acreage is in pasture or rangeland. These soils are well suited to crops, pasture, and rangeland. Forage and grain sorghums, cotton, and small grains are the main crops. The soils are moderately well suited to use as habitat for wildlife.

The soils in this map unit are poorly suited to most urban uses. The shrinking and swelling of the soil with changes in moisture, the very slow permeability, the low strength which affects roads and streets, and corrosivity are limitations that are difficult to overcome. These soils are moderately well suited to recreational uses because of the clayey texture and very slow permeability.

5. Ponder-Sanger-Slidell

Nearly level to gently sloping, deep, slightly acid to moderately alkaline loamy and clayey soils; on uplands

This map unit consists of well drained soils that have slopes of 0 to 5 percent. The unit makes up 12 percent of the county. It is about 34 percent Ponder soils, 27 percent Sanger soils, 9 percent Slidell soils, and 30 percent soils of minor extent.

The gently sloping Ponder soils are on uplands. These soils are moderately well drained, and permeability is slow. Typically, the surface layer is brown clay loam about 5 inches thick. The upper part of the subsoil to a depth of 40 inches is brown clay, grading to grayish brown. The lower part of the subsoil to a depth of 60 inches is pale brown clay loam. It has many concretions and soft masses of calcium carbonate.

The gently sloping Sanger soils are on uplands. These soils are well drained, and permeability is very slow. Typically, these soils are clay to a depth of 72 inches. The surface layer to a depth of about 37 inches is very dark grayish brown in the upper part and dark grayish brown in the lower part. The layer below that is brown to light yellowish brown. The underlying material to a depth of 80 inches is yellow shaly clay.

The nearly level to gently sloping Slidell soils are on uplands. These soils are well drained, and permeability is very slow. Typically, these soils are clay to a depth of 72 inches. They are very dark gray to dark gray in the upper part, grading to grayish brown and light brownish gray in the lower part. The underlying material to a depth of 80 inches or more is light brownish gray shaly clay that has yellowish and brownish mottles.

Of minor extent in this map unit are Birome, Burleson, Crosstell, Culp, Frio, Gowen, Hassee, Hensley, Lewisville, Lindale, Lott, Medlin, Pursley, Rader, Rayex, and Wilson soils. The moderately deep, gently sloping to moderately steep, loamy Birome and Lindale soils are on uplands. The deep, gently sloping to moderately steep, clayey Burleson, Lewisville, Lott, and Medlin soils are on uplands. The deep, nearly level to sloping, loamy Crosstell, Culp, Hassee, Rader, and Wilson soils are on uplands. The deep, nearly level, clayey Frio soils are on flood plains of streams. The deep, nearly level, loamy Gowen and Pursley soils are on flood plains of streams. The shallow, gently sloping to moderately steep, loamy Hensley and Rayex soils are on uplands.

The soils in this unit are used mainly for pasture or crops. These soils are well suited to cultivated crops. Grain and forage sorghums, cotton, and small grains are the main crops. These soils are well suited to pasture and rangeland. Forage yields of improved bermudagrass and kleingrass are high. Rangeland is a mixture of tall and mid grasses. The soils in this unit are moderately well suited to use as habitat for wildlife.

The soils in this unit are poorly suited to urban uses. The shrinking and swelling of the soil with changes in moisture, the slow permeability, the low strength that affects roads and streets, and corrosivity are limitations that are difficult to overcome. These soils are moderately well suited to recreational uses because of the slow permeability and the clayey texture.

6. Bolar-Brackett-Aledo

Strongly sloping to steep, very shallow to moderately deep, moderately alkaline loamy, stony, and gravelly soils; on uplands

This map unit is dominantly made up of well drained soils that have slopes of 8 to 60 percent. This unit makes up about 5 percent of the county. It is about 23 percent Bolar soils, 20 percent Brackett soils, 8 percent Aledo soils, and 49 percent soils of minor extent.

The strongly sloping to steep Bolar soils are on side slopes where they are mixed with narrow bands of Aledo soils. Bolar soils are well drained, and permeability is moderate. Typically, the surface layer is stony clay loam about 19 inches thick. The subsoil to a depth of 37 inches is clay loam that is brown in the upper part and pale yellow in the lower part. The underlying material is fractured limestone interbedded with calcareous marl.

The moderately steep to very steep Brackett soils are on side slopes. Brackett soils are well drained, and permeability is moderately slow. Typically, the surface layer is grayish brown loam about 8 inches thick. The layer below that to a depth of 14 inches is light brownish gray loam. The underlying material is interbedded limestone and light brownish gray loam.

The strongly sloping to steep Aledo soils are on side slopes where they are mixed with bands of Bolar soils. Aledo soils are well drained, and permeability is moderate. Typically, the surface layer is dark grayish brown gravelly clay loam about 6 inches thick. The layer below that to a depth of 18 inches is dark grayish brown very gravelly clay loam. The underlying material is coarsely fractured limestone.

Of minor extent in this map unit are Frio, Purves, Sanger, Slidell, and Sunev soils and Rock outcrop. The soils on uplands are the deep, nearly level to gently sloping, clayey Sanger and Slidell soils; the deep, gently sloping, loamy Sunev soils; and the shallow, gently sloping, clayey Purves soil. The deep, nearly level, clayey Frio soils are on flood plains of streams. Rock outcrops are in the steeper parts of the area.

The soils in this unit are mainly used as rangeland. The soils are moderately well suited to rangeland. Native vegetation is mid and tall grasses and scattered live oak trees. These soils are moderately well suited to use as habitat for wildlife because the vegetation provides good cover and protection.

The soils in this unit are not suited to use for pasture or crops because of stoniness, slope, shallow rooting depth, and susceptibility to water erosion.

The soils in this unit are poorly suited to most urban and recreational uses. Depth to rock, slope, and stoniness are limitations that are difficult to overcome.

7. Minwells-Bastrop-Yahola

Nearly level to gently sloping, deep, slightly acid to moderately alkaline loamy soils; on upland terraces and the flood plain of the Brazos River

This map unit consists of well drained soils that have slopes of 0 to 5 percent. The unit makes up about 2 percent of the county. It is about 18 percent Minwells soils, 18 percent Bastrop soils, 8 percent Yahola soils, and 56 percent soils of minor extent.

The gently sloping Minwells soils are on upland terraces. These soils are well drained, and permeability is slow. Typically, the surface layer is brown fine sandy loam about 7 inches thick. The subsoil to a depth of 48 inches is red sandy clay and to a depth of 62 inches is yellowish red gravelly sandy clay loam.

The nearly level to gently sloping Bastrop soils are on upland terraces. These soils are well drained, and permeability is moderate. Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsoil to a depth of 80 inches is sandy clay loam that is reddish brown in the upper part and yellowish red in the lower part.

The nearly level to gently sloping Yahola soils are on the flood plain of the Brazos River. These soils are well drained, and permeability is moderately rapid. Typically, the surface layer is reddish brown fine sandy loam about 17 inches thick. The underlying material to a depth of 60 inches is stratified fine sandy loam and loam. It is brown fine sandy loam in the upper part, reddish yellow loam in the middle part, and yellowish red fine sandy loam in the lower part.

Of minor extent in this unit are Aledo, Bolar, Callisburg, Decordova, Gaddy, Hassee, Luckenbach, Paluxy, and Ustorthents soils. The deep, gently sloping, loamy Callisburg, Hassee, and Luckenbach soils are on upland terraces. The deep, nearly level to gently sloping, sandy Decordova soils are on upland terraces. The deep, sandy Gaddy soils are intermingled with the Yahola soils on the flood plain of the Brazos River. The shallow Aledo soils and the moderately deep Bolar soils are along the upland margins in higher positions. The deep, loamy Ustorthent soils are strongly sloping to steep piles of soil material that was left in gravel and sand pits.

The soils in this unit are used mainly for pasture. Some acreage is used for crops and orchards or as rangeland. These soils are well suited to pasture, crops, rangeland, or orchards. Yields of improved bermudagrass are high if sufficient moisture is available. Peanuts is the major crop, but some forage sorghum and truck crops are also grown. These soils are well suited to use as habitat for wildlife.

The soils in this unit are mainly well suited to urban and recreational uses; the Yahola soils, however, are not suited because of the flooding hazard. The shrinking and swelling of the soil with changes in moisture and the slow permeability are limitations in some areas of these soils, but proper design and installation can partly overcome these problems.

8. Burleson-Navo-Wilson

Nearly level to gently sloping, deep, slightly acid to neutral clayey and loamy soils; on uplands

This map unit consists of moderately well drained to somewhat poorly drained soils that have slopes of 0 to 5 percent. The unit makes up about 1 percent of the county. It is about 17 percent Burleson soils, 17 percent Navo soils, 16 percent Wilson soils, and 50 percent soils of minor extent.

The nearly level Burleson soils are on uplands. These soils are moderately well drained, and permeability is very slow. Typically, the soils are clay to a depth of 72 inches. They are dark gray to very dark gray in the upper part, dark gray with brownish mottles in the middle part, and grayish brown mottled with yellow in the lower part.

The nearly level to gently sloping Navo soils are on uplands. These soils are moderately well drained, and permeability is very slow. Typically, the surface layer is brown clay loam about 5 inches thick. The layer below that to a depth of 62 inches is brownish clay that is mottled in shades of red, brown, yellow, and gray.

The nearly level to gently sloping Wilson soils are on uplands. These soils are somewhat poorly drained, and permeability is very slow. Typically, the surface layer is dark grayish brown silty clay loam about 7 inches thick. The subsoil to a depth of 66 inches is silty clay that is dark gray in the upper part, dark grayish brown in the middle part, and grayish brown in the lower part. The underlying material is silty clay that is mottled in shades of gray and brown.

Of minor extent in this unit are Gowen, Heiden, Lewisville, Pursley, Seawillow, and Tinn soils. The deep, loamy Gowen and Pursley soils and the deep, clayey Tinn soils are on nearly level flood plains of streams. The deep, clayey Heiden and Lewisville soils are on uplands. The moderately deep, loamy Seawillow soils are also on uplands.

The soils in this unit are used mainly for crops or pasture. They are moderately well suited to cultivated crops, such as grain and forage sorghums, small grains, and cotton. These soils are well suited to improved bermudagrass and kleingrass and for rangeland use. They are moderately well suited to use as habitat for wildlife.

The soils in this unit are poorly suited to urban uses. The shrinking and swelling of the soil with changes in moisture, the slow permeability, the clayey texture, and corrosivity are limitations that are difficult to overcome. These soils are moderately well suited to recreation uses except for the areas of Wilson soils. The wetness of the Wilson soils, together with slow permeability, and the clayey surface layer are limitations.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Gasil fine sandy loam, 1 to 3 percent slopes, is one of several phases in the Gasil series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Ferris-Heiden complex, 2 to 5 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Descriptions of the detailed soil map units follow.

AbC—Aledo-Bolar complex, 2 to 8 percent slopes. This complex consists of Aledo and Bolar soils on ridgetops and side slopes. These soils are shallow to moderately deep. The side slopes have horizontal limestone bedrock that outcrops about every 4- to 30-foot change in elevation. The Rock outcrop gives the area of soils a benched or terraced appearance. Fragments of limestone ranging from 1 inch to 12 inches across the long axis cover 1 to 20 percent of the surface. Slopes are typically 1 to 8 percent, but the Aledo soil ranges to as much as 12 percent in some areas. Areas are irregular in shape and range from 8 to 1,200 acres.

The composition of this complex is more variable than that of other map units in the county. About 60 percent of this complex is Aledo soil, about 20 percent Bolar soil, and about 20 percent other soils and Rock outcrop. These percentages were determined by taking samples from random transects made across mapped areas. The Aledo soil is on the ridgetops and on the side slopes near Rock outcrop. The Bolar soil is in narrow bands on the side slopes. The soils are so intricately mixed that mapping them separately was not practical.

Typically, the Aledo soil has a surface layer of dark grayish brown clay loam about 5 inches thick, which is about 10 percent, by volume, fragments of limestone less than 3 inches in diameter and about 4 percent, by volume, fragments 3 to 5 inches in diameter. The layer below that to a depth of about 12 inches is grayish brown very gravelly clay loam that is about 75 percent, by volume, fragments of limestone ranging from 1/2 inch to 8 inches across the long axis. The underlying material is coarsely fractured, indurated limestone. The soil is calcareous throughout.

The Bolar soil has a surface layer of very dark grayish brown clay loam about 6 inches thick. The layer below that is dark grayish brown clay loam to a depth of about 12 inches. The upper part of the subsoil to a depth of about 24 inches is grayish brown clay loam. The lower part to a depth of 36 inches is very pale brown clay loam. The underlying material is fractured, indurated limestone bedrock. The soil is calcareous throughout.

The soils in this complex are well drained. Surface runoff is medium to rapid. Permeability is moderate, and the available water capacity is low to very low. The rooting zone is shallow to moderately deep; root penetration is restricted by the limestone layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Brackett, Hensley, Lewisville, Purves, Seawillow, and Sunev soils and Rock outcrop. Also included are soils that are lighter in color or that have higher content of clay than Aledo or Bolar soil. The included soils make up 20 percent of the map unit.

The soils in this complex are used as rangeland. This map unit comprises the major part of the rangeland in the county. These soils produce moderate yields of forage. The soils in this complex are not suited to use for cultivation or pasture because of stoniness, slope, shallow rooting depth, and the very low to low available water capacity.

The soils in this complex are poorly suited to most urban and recreation uses because of depth to rock, stoniness, and slope. These limitations are difficult to overcome.

Suitability for use as habitat for wildlife is poor. Deer and quail inhabit this area mainly for cover.

This Aledo-Bolar complex is in capability subclass VIs. The Aledo soil is in the Shallow range site, and the Bolar soil is in the Clay Loam range site.

AtB—Altoga silty clay, 2 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are circular to oblong on low knolls and are long, narrow bands on low ridges. They range from 6 to 80 acres.

Typically, this soil has a surface layer of grayish brown silty clay about 4 inches thick. The subsoil to a depth of about 37 inches is very pale brown silty clay. The underlying material to a depth of 62 inches or more is mottled brownish yellow, yellowish brown, and very pale brown shaly clay that has strata of sandstone. This soil is moderately alkaline throughout.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is high. This soil has fair tilth and can be worked within a medium range of moisture content. The rooting zone is deep, and it is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Ferris, Heiden, and Lewisville soils. The included soils make up less than 15 percent of the map unit.

This soil is used mostly for crops, mainly forage and grain sorghums.

This soil is moderately suited to use for crops. Good management includes timely and limited tillage, rotation of crops, and leaving residue on the surface when crops are not grown. These practices help control water erosion and conserve moisture. Residue also helps to maintain soil productivity. Terraces are needed to help prevent water erosion.

This soil is moderately suited to use for pasture. Improved bermudagrass, kleingrass, and lovegrass are suitable pasture plants. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use as habitat for wildlife. Forbs and grain crops provide food for doves and quail.

This soil is poorly suited to most urban uses. The shrinking and swelling of the soil with changes in moisture, low strength which affects roads and streets, and corrosivity to uncoated steel are the main limitations. This soil is moderately suited to most recreation uses because of the silty clay texture.

This Altoga soil is in capability subclass IIIe and in the Clay Loam range site.

BaB—Bastrop fine sandy loam, 0 to 3 percent slopes. This deep, well drained, nearly level to gently sloping soil is on geologic terraces of the Brazos River. Slopes average about 1 1/2 percent. Areas are irregular in shape and range from 8 to 100 acres.

This soil has a surface layer of slightly acid, brown fine sandy loam about 8 inches thick. The subsoil is neutral, reddish brown sandy clay loam to a depth of about 30 inches and neutral, yellowish red sandy clay loam to a depth of 80 inches or more.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Callisburg, Decordova, Minwells, and Paluxy soils. Also included are small areas of soils that have slopes of 3 to 5 percent and small eroded areas of soils that have a loam or clay loam surface layer. The included soils make up less than 15 percent of the map unit.

This soil is well suited to peanuts, grain and forage sorghums, and truck crops. Minimum tillage, stripcropping, and the use of cover crops and grasses and legumes in the cropping system help reduce runoff and control soil blowing. Returning crop residue to the soil helps conserve moisture, control runoff, reduce soil temperature, and maintain soil tilth and productivity.

This soil is well suited to use for pasture. Improved bermudagrass, kleingrass, lovegrass, switchgrass, arrowleaf clover, and vetch are suitable pasture plants. Management includes controlling grazing to maintain adequate plant height, fertilizing to replace soil nutrients, and spraying or mowing to control weeds. This soil is well suited to fruit and pecan orchards.

This soil is well suited to most urban and recreational uses. The moderate permeability limits the use of this soil as septic tank filter fields, but special design and careful installation can easily overcome this limitation.

This soil is well suited to wildlife habitat. Areas of this soil furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, doves, and squirrels.

This Bastrop soil is in capability subclass IIe and in the Sandy Loam range site.

BaC—Bastrop fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces of the Brazos River. Areas are irregular in shape and range from 12 to 125 acres.

This soil has a surface layer of slightly acid, brown fine sandy loam about 16 inches thick. The subsoil is slightly acid, red sandy clay loam to a depth of about 22 inches and medium acid, red sandy clay loam to a depth of 72 inches.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is high. This soil has fair tilth and can be worked within a medium range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Decordova, Minwells, and Paluxy soils. Also included are small areas of eroded Bastrop soils that have loam and sandy clay loam surface layers that were mixed by plowing. The included soils make up less than 15 percent of the map unit.

This soil is used mostly for pasture; some idle fields are naturally revegetated with range forages.

This Bastrop soil is moderately suited to use for pasture. Adapted species are improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover. Proper management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. Slope, the hazard of erosion, and low natural fertility are limitations. Terracing and contour farming help to slow runoff. Growing cover crops and returning crop residue to the surface help to maintain tilth and to reduce soil blowing and water erosion.

This soil is well suited to most urban uses. Low strength affecting streets and roads and the hazard of erosion are limitations, but proper design and careful installation can easily overcome these limitations. The moderate permeability is a limitation for use of this soil as septic field absorption fields. This soil is well suited to most recreational uses. Slope is a limitation for playgrounds.

This soil is well suited to use as habitat for wildlife. Areas of this soil furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, doves, and squirrels.

This Bastrop soil is in capability subclass IIIe and in the Sandy Loam range site.

BmE—Birome-Rayex complex, 5 to 20 percent slopes. This complex consists of moderately deep Birome soil and shallow Rayex soil. These soils are well drained, sloping to moderately steep, and are on uplands. They are on narrow ridges and hilltops. Slopes average about 6 percent. Fragments of sandstone and ironstone ranging to as much as 20 inches in diameter are on 2 to 20 percent of the surface (fig. 4). Areas are oblong to irregularly shaped and range from 8 to 50 acres.

About 50 percent of this complex is Birome soil, about 30 percent Rayex soil, and about 20 percent other soils. These percentages were determined by taking samples from random transects made across mapped areas. The Birome and Rayex soils are so intricately mixed that mapping them separately was not practical.

The Birome soil in this complex has a surface layer of neutral, brown, stony fine sandy loam that is about 4 inches thick. The next layer is slightly acid, light yellowish brown gravelly sandy loam about 2 inches thick. The upper part of the subsoil is strongly acid, yellowish red clay to a depth of about 17 inches. It has common medium distinct mottles of strong brown and reddish yellow. The middle part to a depth of about 28 inches is strongly acid, reddish yellow clay that has common fine and medium distinct brownish yellow and yellowish red mottles. The lower part to a depth of 35 inches is strongly acid, brownish yellow clay that has few fine distinct yellowish red mottles. The underlying material is weakly cemented fractured sandstone interbedded with pale olive shaly clay.

The Birome soil in this complex is well drained. Runoff is rapid. Permeability is slow, and the available water capacity is medium. Natural fertility and organic matter content are low. The rooting zone is moderately deep, but penetration of roots is restricted by clay in the lower layers. Soil blowing is a slight hazard, and water erosion is a severe hazard.

The Rayex soil in this complex has a surface layer of neutral, brown, stony fine sandy loam about 4 inches thick. The subsoil to a depth of 15 inches is strongly acid, red clay. The underlying material is weakly cemented sandstone interbedded with red clay.

The Rayex soil is well drained. Runoff is rapid. Permeability is moderately slow, and the available water capacity is very slow. Natural fertility and organic matter content are low. The rooting zone is shallow, and penetration by plant roots is difficult because of rock fragments and clayey subsoil. Soil blowing is a slight hazard, and water erosion is a severe hazard.

Included in mapping are small areas of Crosstell, Gasil, and Silstid soils. Also included are small eroded areas of soils that have a clayey surface texture, outcrops of sandstone, and small areas of soils that have a very strongly acid subsoil over clayey shale and shale. The included soils make up less than 30 percent of the map unit.

These soils are used as rangeland. Yields of native forage are moderate.

The soils in this complex are not suitable for cultivation or pasture because of stoniness, slope, the severe erosion hazard, and shallow rooting depth.

The soils in this complex are poorly suited to most urban uses. Depth to rock, slow permeability, slope, and corrosivity to uncoated steel are the main limitations.

Figure 4.—Area of Birome-Rayex complex, 5 to 20 percent slopes, showing sandstone fragments on the surface and characteristic scruhby oak trees.

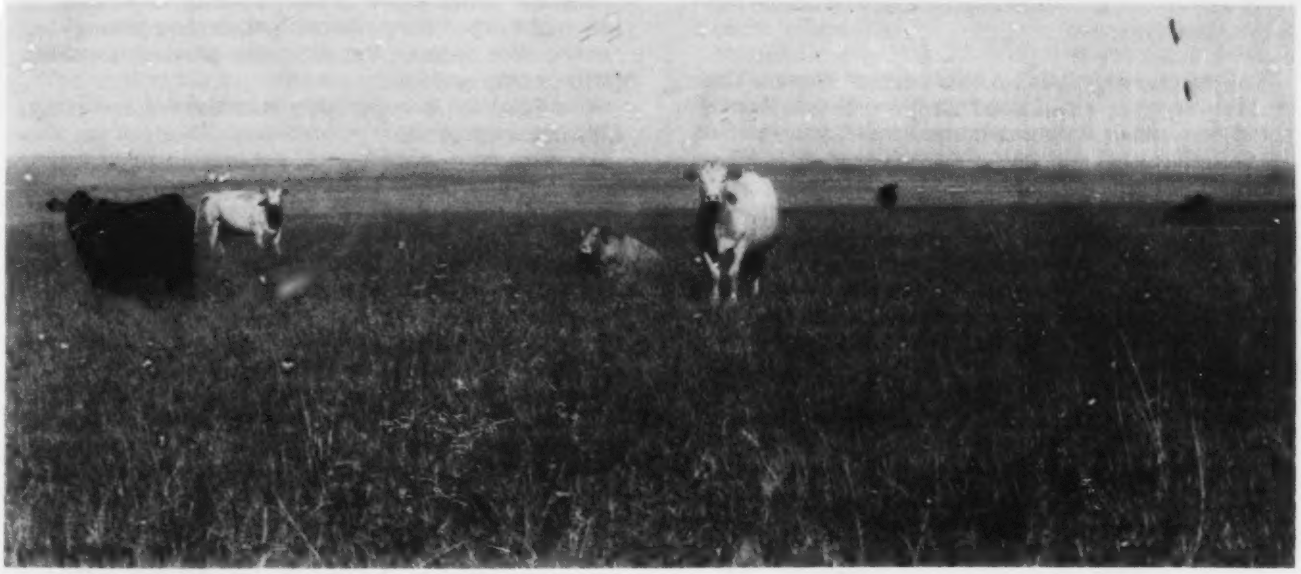


Figure 5.—Rangeland that has been seeded with King Ranch bluestem on Bolar clay loam, 1 to 3 percent slopes.

These soils are moderately suited to most recreation uses. Slope, large stones, and shallow depth are limitations.

These soils are moderately suited to use as habitat for wildlife. Areas of these soils produce an abundance of woody plants for food and cover for quail, doves, songbirds, and squirrels.

This Birome-Rayex complex is in capability subclass VIIs and in the Sandstone Hill range site.

BoB—Bolar clay loam, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Slopes average about 2 percent. Soil areas are irregular in shape and range from 8 to 40 acres.

This soil has a surface layer of dark grayish brown clay loam about 14 inches thick. The upper part of the subsoil to a depth of 26 inches is brown clay loam. The lower part to a depth of 35 inches is pale brown clay loam. Indurated limestone interbedded with calcareous marl is at a depth of 35 inches. This soil is moderately alkaline throughout.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is low. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is moderately deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo, Denton, Krum, Seawillow, Lewisville, and Purves soils. The included soils make up less than 25 percent of the map unit.

This soil is used mainly as native rangeland (fig. 5). Some acreage is used for pasture or small grains.

This soil is well suited to use as pasture. Improved bermudagrass, kleingrass, switchgrass, vetch, and singletary peas are suitable pasture plants. These plants respond well to fertilizer.

This soil is moderately suited to use for crops. Low available water capacity limits production. The soil is best suited to cool-season crops. Growing closely spaced crops, such as small grains, and returning crop residue to the soil help to slow runoff and maintain tilth.

This soil is moderately suited to most urban uses. The shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and depth to rock are the main limitations. The rock layer limits the amount of grading and leveling that can be easily done. Septic tank absorption systems work satisfactorily if the absorption field is of proper size.

This soil is well suited to most recreation uses. The depth to rock, the clay loam surface that is sticky when wet, and slope are the main limitations. Using loamy fill material and maintaining a good grass cover help to overcome the limitation of the sticky surface during wet periods.

This soil is well suited to use as habitat for wildlife. Areas of this map unit are preferred by quail and ground-nesting birds because the vegetation provides excellent ground cover and food.

This Bolar soil is in capability subclass IIe and in the Clay Loam range site.

BoC—Bolar clay loam, 3 to 8 percent slopes. This moderately deep, well drained, gently sloping to sloping soil is on uplands. Slopes average about 5 percent. Soil areas are irregular in shape and range from 10 to 50 acres.

This soil has a surface layer of dark grayish brown clay loam about 6 inches thick. The subsurface layer is very dark grayish brown clay loam about 8 inches thick. The subsoil to a depth of 24 inches is brown clay loam and to 31 inches is very pale brown clay loam. The underlying material is fractured limestone bedrock interbedded with marl. This soil is calcareous throughout.

This soil is well drained. Surface runoff is medium to rapid. Permeability is moderate, and the available water capacity is low. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is moderately deep and is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo, Brackett, Krum, Seawillow, Lewisville, Purves, and Sunev soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly as native rangeland, but some acreage is used for pasture or small grains.

This Bolar soil is moderately suited to use for pasture. The high lime content of the subsoil and the low available water capacity limit production. Improved bermudagrass, kleingrass, switchgrass, vetch, and singletary peas are suitable pasture plants for this soil. Fertilizing, controlling weeds, and controlling grazing help to produce high yields.

This soil is moderately suited to use for crops. The low available water capacity and runoff limit production. Terracing and farming on the contour help to slow runoff and to allow more water to enter the soil. Grassed waterways are needed for removal of excess terrace water. Growing closely spaced crops, such as small grains, and returning crop residue to the soil help to control erosion and to maintain soil tilth.

This soil is moderately suited to most urban uses. Depth to rock, the shrinking and swelling of the soil with changes in moisture, and corrosivity to uncoated steel are the main limitations. The rock layer limits the amount of grading and leveling that can be easily done, and it restricts downward movement of water. Seepage from septic tank absorption fields may occur on steeper areas.

This soil is moderately suited to most recreation uses. Slope, depth to rock, and the clay loam surface that is sticky when wet are the main limitations. Using loamy fill material and maintaining a good grass cover help overcome the limitation of the sticky surface during wet periods.

This soil is well suited to use as habitat for wildlife. Areas of this soil are preferred by quail and ground-nesting birds because the vegetation provides excellent ground cover and food.

This Bolar soil is in capability subclass IVe and in the Clay Loam range site.

BpE—Bolar-Aledo complex, 8 to 20 percent slopes. This complex consists of the shallow Aledo soil and the moderately deep Bolar soil. These well drained, strongly sloping to moderately steep soils are on stony limestone breaks and side slopes on uplands. Fragments of limestone ranging from less than 1 inch to 10 inches across the long axis cover 1 to 25 percent of the surface. Slopes are typically 8 to 20 percent, but a few areas that have slopes as steep as 45 percent are included. Areas are irregular in shape and range from 20 to 200 acres.

The composition of this complex is more variable than that of other map units in the county. It is about 55 percent Bolar soil, about 25 percent Aledo soil, and about 25 percent other soils and Rock outcrop. These percentages were determined by taking samples from random transects made across mapped areas. The Bolar soil is in narrow bands on the side slopes. The Aledo soil is in narrower bands adjacent to the horizontal bands of Rock outcrop. These soils are so intricately mixed that mapping them was not practical.

The Bolar soil in this complex has a surface layer of dark grayish brown stony clay loam about 19 inches thick. It is about 25 percent, by volume, fragments of limestone. The upper part of the subsoil to a depth of about 30 inches is brown clay loam that has about 5 percent, by volume, fragments of limestone. The lower part to a depth of 37 inches is pale yellow clay loam. The underlying material is indurated limestone that is coarsely fractured. The soil is calcareous throughout.

The Aledo soil in this complex has a surface layer of dark grayish brown gravelly clay loam about 6 inches thick. It has about 10 percent, by volume, fragments of limestone mostly less than 1 inch in diameter. The layer below that to a depth of 18 inches is dark grayish brown very gravelly clay loam that is about 70 percent, by volume, fragments of limestone ranging from 1/2 inch to 5 inches across the long axis. The underlying material is indurated limestone that is coarsely fractured. The soil is calcareous throughout.

The soils in this complex are well drained. Runoff ranges from medium to rapid. Permeability is moderate, and the available water capacity ranges from very low to low. The rooting zone is shallow to moderately deep, and root penetration is restricted by the limestone layer. Wind erosion and water erosion are slight hazards.

Included in mapping are small areas of Brackett, Purves, and Sunev soils and a soil that is more than 35 percent gravel but otherwise is similar to the Bolar soil. Also included are outcrops of limestone bedrock on slope breaks and a shallow soil that is lighter in color and has clayey texture. The included soils make up 25 percent of the map unit.

The soils in this complex are used as rangeland. They produce high yields of forage if brush is controlled. The soils are not suited to cultivation or pasture because of stoniness, slope, and the low available water capacity.

These soils are poorly suited to most urban uses because of depth to rock, stoniness, and slope. These limitations are difficult to overcome. These soils are moderately suited to most recreation uses.

The soils in this complex are well suited to use as habitat for wildlife. Areas of these soils are preferred by deer, turkey, quail, squirrels, and songbirds because of the excellent food and cover provided by woody and herbaceous plants.

This Bolar-Aledo complex is in capability subclass VIs. The Bolar soil is in the Clay Loam Slopes range site, and the Aledo soil is in the Shallow range site.

BrE—Brackett-Rock outcrop complex, steep. This complex consists of the shallow, well drained, rolling to steep Brackett soil on uplands and Rock outcrop. The soil is on side slopes and in lower positions than soils formed over hard limestone. Slopes are typically 15 to 30 percent but range to as much as 60 percent in some areas. The surface in most places is covered with limestone gravel and fragments as much as 6 inches across. Areas are irregular in shape and range from 25 to 400 acres.

The composition of this complex is more variable than that of most units in the county. It is about 65 percent Brackett soil, about 15 percent Rock outcrop, and about 20 percent other soils. These percentages were determined by taking samples from random transects made across mapped areas. The Brackett soil is on the side slopes. The Rock outcrop is mostly in bands at the top of the slope and is at random on lower slopes. The Brackett soil and Rock outcrop in the complex are so intricately mixed that mapping them was not practical. Mapping was controlled well enough, however, for the anticipated use of the soils.

Typically, the Brackett soil has a surface layer of grayish brown loam about 8 inches thick. Limestone fragments ranging from 1/4 inch to 3 inches make up about 1 percent, by volume, of the surface layer. The subsoil to a depth of 14 inches is light brownish gray loam. The underlying material to a depth of 22 inches is interbedded weakly and strongly cemented limestone and light brownish gray loam. The soil is calcareous throughout.

The soil in this complex is well drained. Surface runoff is rapid. Permeability is moderately slow, and the available water capacity is very low. The rooting zone is shallow, and root penetration is restricted by the fragments of limestone. The Rock outcrop and slope make the use of farm and ranch equipment difficult. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo, Bolar, and Purves soils. Also included are small areas of Brackett very gravelly loam and a dark surfaced soil that has a very gravelly profile. The included soils make up less than 25 percent of the map unit.

The soil in this complex is used as rangeland. It is not suited to cultivation or pasture because of slope, Rock outcrop, shallow rooting depth, fragments of limestone on the surface, and the hazard of susceptibility to water erosion.

The soil in this complex is poorly suited to most urban and recreation uses. Slope, shallow depth to rock, and corrosivity to uncoated steel are the main limitations.

Suitability for wildlife habitat is poor; however, areas provide escape cover for deer and nesting habitat for many birds.

This Brackett-Rock outcrop, steep, complex is in capability subclass VIIs and in the Steep Adobe range site.

BuA—Burleson clay, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on ancient stream terraces. Slopes average about 0.6 percent. Areas are irregular in shape and range from 6 to 120 acres.

Typically, the surface layer is neutral, dark gray clay about 5 inches thick. The layers below that to a depth of 44 inches are mildly alkaline, very dark gray clay. The next layer to a depth of 58 inches is moderately alkaline, dark gray clay. Below that to a depth of 72 inches is moderately alkaline, grayish brown clay.

This soil is moderately well drained. Runoff is slow. Permeability is very slow. When the soil is dry and cracked, water enters rapidly, and when it is moist, water enters very slowly. The available water capacity is high. This soil has poor tilth and can be worked only within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the dense blocky clay in the lower part of the soil. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Heiden, Houston Black, Navo, and Wilson soils. The included soils make up about 15 percent of the map unit.

This soil is used mainly for crops. Some acreage is used for pasture.

This Burleson soil is well suited to use for crops. It is used for small grains and row crops. Growing deep-rooted, soil-improving crops and returning plant residue to the soil help to maintain tilth and productivity. Delaying cultivation until the soil is dry helps to reduce compaction. Rows should be planned so that excess water can safely drain off.

This soil is well suited to use for pasture. Improved bermudagrass, tall fescue, kleingrass, and vetch are suitable. Livestock grazing when the soil is wet causes poor tilth in the surface layer. Proper management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, seasonal wetness, the very slow permeability, and corrosivity to uncoated steel are the main limitations.

This soil is poorly suited to recreation uses. The clayey texture, which causes deep, wide cracks when the soil is dry, and the very slow permeability are the main limitations. Surface drainage is needed.

This soil is moderately suited to use as habitat for wildlife. Doves and quail regularly use this habitat. Forbs and grain crops provide food and cover.

This Burleson soil is in capability subclass IIw and in the Blackland range site.

BuB—Burleson clay, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is on ancient stream terraces. Slopes average about 1.5 percent. Soil areas are irregular in shape and range from 10 to 180 acres.

Typically, the surface layer is neutral, very dark gray clay to a depth of about 36 inches. The layer below that to a depth of about 58 inches is mildly alkaline, dark gray clay. The next layer to a depth of 62 inches is calcareous, mottled gray clay.

This soil is moderately well drained. Runoff is medium. Permeability is very slow. Water enters the soil rapidly when it is dry and cracked and enters very slowly when it is moist. The available water capacity is high. The soil has poor tilth and can only be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the blocky clay in the lower part of the soil. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Culp, Heiden, Houston Black, Navo, and Wilson soils. The included soils make up about 20 percent of the map unit.

This soil is mainly used for crops, and it is well suited to this use. Grain sorghum, cotton, and small grains are the main crops. Management includes controlling erosion and maintaining tilth. Terracing and farming on the contour help to slow runoff and to control erosion. Growing crops that produce large amounts of residue and deep-rooted legumes helps to maintain tilth.

This soil is well suited to use as pasture. Adapted species include improved bermudagrass, tall fescue, kleingrass, johnsongrass, and vetch. Seedbeds are difficult to establish. This soil puddles if livestock are allowed to graze when the soil is wet. Fertilizing, controlling weeds, and controlling grazing help to maintain high yields.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the major limitations. Good design and careful installation can partly overcome these limitations.

This soil is poorly suited to recreation uses. The main limitations are the very slow permeability and the clay texture throughout the soil. The clay causes deep, wide cracks to form when the soil is dry and stickiness when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil are regularly inhabited by doves and quail. Grain crops and an abundant supply of forbs provide food and cover.

This Burleson soil is in capability subclass IIe and in the Blackland range site.

CaB—Callisburg fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on ancient high terraces and uplands near the Brazos River. Slopes average about 1.5 percent. Areas are irregular in shape and range from 8 to 360 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 14 inches thick. The upper part of the subsoil to a depth of about 24 inches is slightly acid, brown sandy clay that has red and dark reddish brown mottles. The next layer to a depth of 32 inches is medium acid, strong brown sandy clay that has red and yellowish red mottles. Below that to a depth of 42 inches is medium acid, yellowish red sandy clay that has red and strong brown mottles. The next layer to a depth of 68 inches is mildly alkaline, reddish yellow sandy clay that has red and yellowish red mottles. The underlying material is mildly alkaline, mottled yellowish red and strong brown gravelly sandy clay loam to a depth of 74 inches.

This soil is well drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is high. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep, but root penetration is somewhat restricted by the lower layers of sandy clay. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Bastrop, Hassee, and Minwells soils. Also included are a few areas of soils that have a loamy fine sand surface layer. The included soils make up less than 20 percent of the map unit.

This soil is moderately suited to use for pasture. Adapted pasture plants are improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover. Good management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. Suitable crops include wheat, oats, peanuts, watermelons, and truck crops. Low natural fertility and the droughtiness of the clayey subsoil are limitations. Management includes controlling soil blowing and water erosion, conserving moisture, and maintaining tilth and fertility. Terracing and farming on the contour help to slow runoff. Returning crop residue to the soil helps to control soil blowing and to conserve moisture. Growing cool-season legumes aids in maintaining tilth and fertility and in controlling erosion.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. Septic tank absorption fields are poorly suited to this soil because of the moderately slow permeability. Proper design and careful installation can overcome most limitations. This soil is well suited to most recreation uses. Slope is a problem for playgrounds.

This soil is well suited to use as habitat for wildlife. The abundance of woody and herbaceous plants provide excellent food and cover for deer, quail, doves, and squirrels.

This Callisburg soil is in capability subclass IIe and in the Sandy Loam range site.

CoB—Coving loamy fine sand, 0 to 3 percent slopes. This deep, somewhat poorly drained, nearly level to gently sloping soil is on uplands. Slopes average about 1.2 percent. Areas are irregular in shape and range from 10 to 50 acres.

Typically, the surface layer is neutral, pale brown loamy fine sand about 8 inches thick. The layer below that is slightly acid, light yellowish brown loamy fine sand to a depth of about 31 inches. The subsoil to a depth of 44 inches is medium acid, light yellowish brown sandy clay loam that has strong brown and light brownish gray mottles; to a depth of 62 inches is slightly acid, light gray sandy clay loam that has strong brown and red mottles, and to a depth of 80 inches is slightly acid, light gray sandy clay loam that has strong brown, red, and gray mottles.

This soil is somewhat poorly drained. A perched high water table is at the top of the more clayey lower layers for short periods following heavy rains. Runoff is slow. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard. The soil is flooded by shallow, slow-moving water during periods of high rainfall once in 10 to 20 years.

Included in mapping are small areas of Gasil, Hassee, Pulexas, Rader, and Silstid soils. Also included is a soil that is more clayey in the lower part of the profile but otherwise is similar to the Coving soil. The included soils make up less than 10 percent of the map unit.

This soil is mainly used for pasture, and it is well suited to this use. Improved bermudagrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover are adapted plants. Management includes fertilizing at planned intervals throughout the grazing season, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. Low natural fertility limits production. Corn, small grains, peanuts, and watermelons are adapted to this soil. Good management includes controlling soil blowing, conserving soil moisture, and maintaining soil fertility. Growing crops that produce large amounts of residue, stripcropping, and fertilizing help to control soil blowing and maintain fertility.

This soil is poorly suited to most urban uses because of the flooding hazard. The perched water table and corrosivity to uncoated steel and concrete are limitations, but special design and careful installation can overcome these limitations. The moderately slow permeability is a limitation for septic tank absorption systems.

This soil is poorly suited to most recreation uses. The sandy surface, which blows when the surface is bare of vegetation, and the hazard of flooding are the main limitations.

This soil is well suited to use as habitat for wildlife. This habitat is used by deer, squirrels, raccoons, doves, and quail because the large variety of herbaceous and woody plants provide excellent food and cover.

This Coving soil is in capability subclass IIIs and in the Sandy range site.

CrB—Crosstell fine sandy loam, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Slopes average about 1.5 percent. Areas are irregular in shape and range from 5 to 150 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 7 inches thick. The subsoil to a depth of about 20 inches is strongly acid, reddish yellow clay that has yellowish brown mottles; to a depth of 41 inches is strongly acid, reddish yellow clay that has yellowish red mottles; and to a depth of about 60 inches is neutral, prominently and coarsely mottled, brownish yellow and yellowish red clay.

This soil is moderately well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. This soil has fair tilth and can be worked within a fairly narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the dense blocky clay in the lower part of the soil. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Gasil, Hassee, Rader, and Silstid soils. Also included are small areas of Crosstell soils that have a surface layer more than 10 inches thick. The included soils make up less than 15 percent of the map unit.

Most areas of this soil were formerly used for crops; however, they have been allowed to revegetate to unimproved pasture or to rangeland.

This soil is moderately suited to use for crops. It is limited by the thin surface layer, the dense, clayey, acid subsoil, and low natural fertility. Terracing and contour

Figure 6.—A house under construction on Crosstell fine sandy loam, 1 to 3 percent slopes. This soil has high shrink-swell potential, but special design and careful construction can generally overcome this limitation.

farming are needed to reduce erosion. Growing deep-rooted, soil-improving crops and returning crop residue to the soil help to improve soil tilth and reduce erosion. Cover crops grown during the cool season are best suited to this soil.

This soil is moderately suited to use for pasture. The droughty nature of the clayey subsoil limits the amount of forage produced. Improved bermudagrass, kleingrass, weeping lovegrass, vetch, singletary peas, and arrowleaf clover are available pasture plants. Fertilizing, controlling weeds, and controlling grazing are needed for high forage yields.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel and concrete, and the very slow permeability are the main limitations (fig. 6). Special design and careful installation can help to overcome these limitations.

This soil is moderately suited to most recreation uses. Permeability is the main limitation. A good grass cover is essential to prevent erosion.

This soil is moderately suited to use as habitat for wildlife, such as doves and quail. The variety of forbs is mainly used by birds and small mammals.

This Crosstell soil is in capability subclass IIIe and in the Tight Sandy Loam range site.

CrD—Crosstell fine sandy loam, 3 to 8 percent slopes. This deep, moderately well drained, gently sloping to sloping soil is on uplands. Areas are irregular in shape and range from 5 to 500 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 5 inches thick. The subsoil to a depth of about 20 inches is medium acid, mottled yellowish red clay; to a depth of 30 inches is medium acid, yellow clay that has common medium prominent mottles of red; to a depth of 41 inches is medium acid, brownish yellow clay that has many coarse prominent red mottles, and to a depth of 51 inches is slightly acid, prominently mottled red, dark red, brownish yellow, yellowish brown and light gray clay. The underlying material to a depth of 76 inches is mildly alkaline, mottled light gray, gray, reddish yellow, yellowish red, and strong brown shaly clay stratified with weakly cemented sandstone.

This soil is moderately well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. This soil has fair tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the dense blocky clay in the subsoil. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Birome, Gasil, Minwells, Silstid, Navo, and Ponder soil. Also included are small areas of Crosstell soils that are moderately eroded, and a soil that is more permeable. The included soils make up less than 20 percent of the map unit.

Most areas of this soil were formerly used for crops; however, they have been allowed to revegetate to unimproved pasture or to range plants.

This soil is moderately suited to use for pasture. Rapid runoff and droughtiness of the subsoil limit the forage yields. Improved bermudagrass, weeping lovegrass, kleingrass, vetch, and singletary peas are suitable pasture plants. Fertilizing, controlling weeds, and controlling grazing are needed for high forage yields.

This soil is poorly suited to use for crops. The severe hazard of erosion, droughtiness, and low fertility are the main limitations. Terracing and contour farming are needed to reduce erosion. Returning crop residue to the soil helps to slow runoff, improve soil tilth, and prevent soil blowing.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel and concrete, and the hazard of erosion are limitations, but proper design and careful installation can partly overcome these limitations. This soil is poorly suited to use as septic tank absorption fields because of the very slow permeability. Slope and permeability are limitations for recreation uses.

This soil is moderately suited to use as habitat for wildlife, such as doves and quail. The variety of forbs is mainly used by birds and small mammals.

This Crosstell soil is in capability subclass IVe and in the Tight Sandy Loam range site.

CuB—Culp clay loam, 0 to 3 percent slopes. This deep, moderately well drained, nearly level to gently sloping soil is on ancient terraces and uplands. Areas are irregular in shape and range from 6 to 140 acres.

Typically, the surface layer is neutral, dark grayish brown clay loam about 6 inches thick. The subsoil to a depth of 16 inches is neutral, very dark grayish brown clay; to a depth of 32 inches is mildly alkaline, brown clay; to a depth of 44 inches is moderately alkaline, yellowish brown clay that has reddish and yellowish mottles; and to a depth of 61 inches is moderately alkaline, pale yellow clay that has yellowish brown and brownish yellow mottles and many concretions and soft masses of calcium carbonate. The underlying material to a depth of 72 inches is moderately alkaline, reddish yellow clay loam that has very pale brown and yellowish brown mottles and common concretions and soft masses of calcium carbonate.

This soil is moderately well drained. Runoff is slow. The available water capacity is high, and permeability is slow. The rooting zone is deep, but root penetration is restricted by the dense clay in the lower part of the profile. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Burleson, Bowen, Ponder, Rader, and Wilson soils. The included soils make up about 10 percent of the map unit.

This soil is used mainly for crops. A few areas are in pasture. Grain sorghum, forage sorghum, cotton, and small grains are the main crops (fig. 7).

This soil is well suited to use for crops. Because the clayey subsoil releases moisture slowly, however, the soil tends to be somewhat droughty. Good management includes controlling erosion and maintaining fertility and tilth. Returning crop residue to the soil helps to conserve moisture and improve tilth. Terracing and contour farming help to reduce erosion.

This soil is well suited to use as pasture. Improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover are suitable pasture plants. Fertilizer should be applied to maintain production.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and slow permeability are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is well suited to use as habitat for wildlife. This habitat is preferred by quail and ground-nesting birds because the ground cover and food are excellent.

This Culp soil is in capability subclass IIe and in the Clay Loam range site.

DeC—Decordova loamy fine sand, 0 to 5 percent slopes. This deep, well drained, nearly level to gently undulating soil is on geologic terraces of the Brazos River. Slopes average about 2 1/2 percent. Soil areas are irregular in shape and range from 20 to 175 acres.

Typically, the surface layer is neutral, brown loamy fine sand about 10 inches thick. The subsoil to a depth of 72 inches or more is slightly acid, yellowish red fine sandy loam.

This soil is well drained. Runoff is slow to medium. Permeability is moderately rapid, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Bastrop, Minwells, and Paluxy soils. Also included are small areas

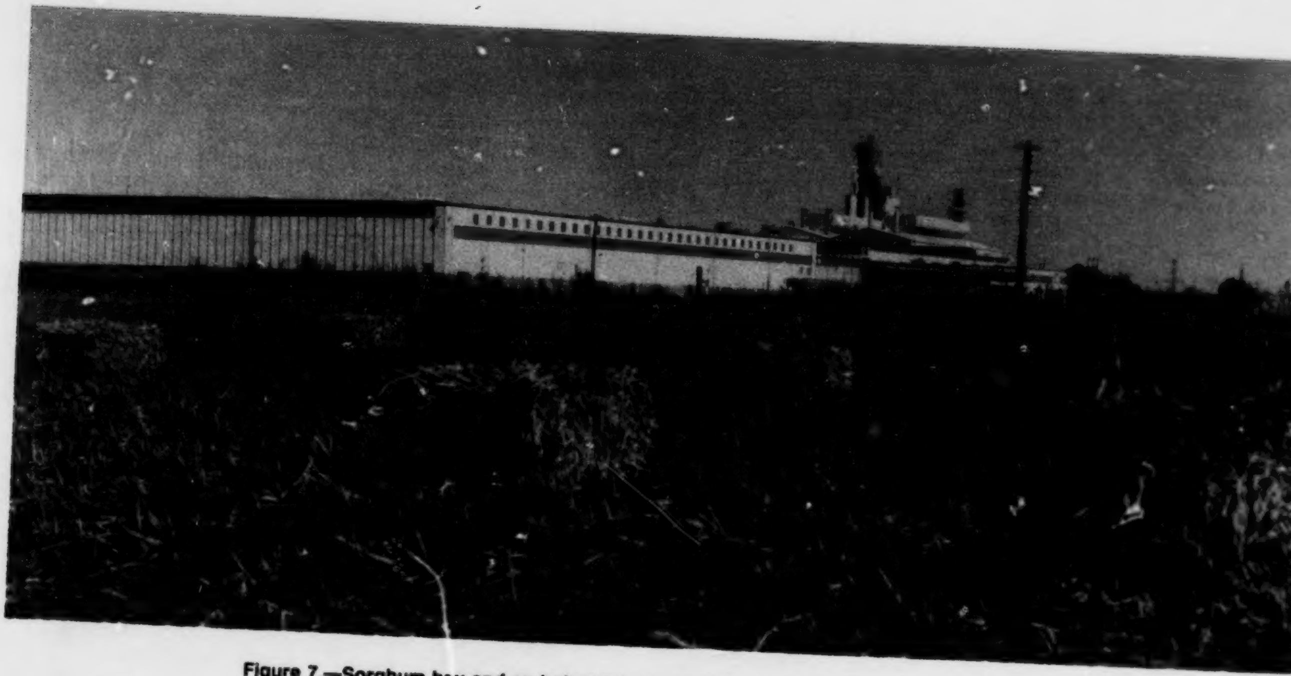


Figure 7.—Sorghum hay and an industrial site on Culp clay loam, 0 to 3 percent slopes.

of a soil that has a sandy surface layer more than 20 inches thick but otherwise is similar to this Decordova soil. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops and orchards. Peanuts are the main crop. Some acreage is used for forage and grain sorghums. Orchards are dominantly pecan.

This soil is moderately suited to use for crops, but low natural fertility and the medium available water capacity are limitations.

Good management includes controlling soil blowing, conserving moisture, and maintaining fertility. Fertilizing, stripcropping, and growing crops that produce large amounts of residue help to control soil blowing, conserve moisture, and maintain fertility.

This soil is well suited to use for pasture. Improved bermudagrass, weeping lovegrass, switchgrass, indiangrass, vetch, and arrowleaf clover are adapted plants. Grass seedlings can be destroyed by blowing sand unless practices that control soil blowing are used. Pasture management includes fertilizing at planned intervals throughout the growing season, controlling weeds, and controlling grazing.

This soil is well suited to most urban uses. Corrosivity to uncoated steel and concrete is the main limitation. Design and careful installation can easily overcome this limitation.

This soil is well suited to most recreation uses. The loamy fine sand surface soil is subject to blowing when bare of vegetation, but this hazard can be overcome by maintaining a good grass cover.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide excellent cover and food for deer, quail, and doves.

This Decordova soil is in capability subclass IIIe and in the Loamy Sand range site.

DnB—Denton silty clay, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Slopes average about 1.8 percent. Areas are irregular in shape and range from 8 to 20 acres.

This soil has a surface layer of dark grayish brown silty clay about 8 inches thick. The next layer to a depth of about 21 inches is brown silty clay. Below that to a depth of 38 inches is brown silty clay that is approximately 60 percent, by volume, fragments of limestone ranging from 1/2 inch to 4 inches across the long axis. The underlying material is indurated fractured limestone. This soil is calcareous throughout.

This soil is well drained. Runoff is medium. Permeability is slow, and the available water capacity is medium. This soil has fair tilth and is worked within a narrow range of moisture content. The rooting zone is moderately deep. Root penetration is slightly restricted by the clayey lower layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo, Bolar, Krum, and Purves soils. The included soils make up less than 15 percent of the map unit.

This soil is used for crops and as rangeland. Small grains are the main crop, but other crops can be grown.

This soil is well suited to use for crops. Good management includes controlling erosion and maintaining tilth. Terracing, contour farming, growing crops that produce large amounts of residue, and growing deep-rooted legumes help to control erosion and maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, depth to rock, corrosivity to uncoated steel, and the slow permeability are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is moderately suited to most recreation uses. The main limitation is the silty clay surface that cracks when the soil is dry and is sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. This habitat is preferred by quail and ground-nesting birds because of the ground cover and food.

This Denton soil is in capability subclass IIe and in the Clay Loam range site.

FeD2—Ferris clay, 5 to 12 percent slopes, eroded. This deep, well drained, sloping to strongly sloping soil is on uplands. Sheet erosion has removed nearly 75 percent of the surface layer, and in some areas shallow gullies range from 6 to 18 feet wide and 1 foot to 3 feet deep. Areas are irregular in shape and range from 6 to 30 acres.

Typically, this soil is moderately alkaline clay. The upper part is light olive brown to a depth of about 30 inches, and the lower part is coarsely mottled, light olive brown, gray, and light brownish gray to a depth of 37 inches. The underlying material to a depth of 66 inches is moderately alkaline, mottled gray, yellow, olive brown, and olive yellow, clayey shale.

This soil is well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly, and when the soil is moist, water enters very slowly. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is limited by the heavy clay subsoil. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Altoga, Heiden, and Seawillow soils. The included soils make up less than 10 percent of the map unit.

This soil is used for pasture and drilled forage sorghum.

This soil is moderately suited to use as pasture. Improved bermudagrass, kleingrass, indiangrass, switchgrass, johnsongrass, and sweetclover are suitable pasture plants. The thin surface layer and rapid runoff limit productivity. Fertilizing, controlling weeds, and controlling grazing are necessary to maintain production.

This soil is poorly suited to use for crops and for urban and recreation uses. Slope, gullies, water erosion, the shrinking and swelling of the soil with changes in moisture, and corrosivity to uncoated steel are limitations. Soil slippage is a hazard if deep cuts are made across the slope. The very slow permeability restricts the use of this soil for septic tank absorption fields. Because of the clayey texture, deep, wide cracks form when the soil is dry.

This soil is moderately suited to wildlife habitat. The habitat is used by coyotes, rabbits, quail, and doves.

This Ferris soil in in capability subclass VIe and in the Eroded Blackland range site.

FhC—Ferris-Heiden complex, 2 to 5 percent slopes. This complex consists of deep, well drained, gently sloping Ferris and Heiden soils on uplands. The Ferris soil is more sloping than the Heiden soil. Areas are irregular in shape and range from 5 to 200 acres.

The composition of this complex is more variable than that of other map units in the county. It is about 55 percent Ferris soil, 30 percent Heiden soil, and 15 percent other soils. These soils are so intricately mixed that mapping them was not practical. Composition of this map unit was determined by transects made across the map unit.

Typically, the Ferris soil in this complex has a surface layer of brown clay about 10 inches thick. The next layer is light yellowish brown clay to a depth of about 45 inches. The underlying material to a depth of 60 inches is coarsely mottled, brownish yellow, light gray, and yellowish red shaly clay. This soil is calcareous throughout. Much of the Ferris soil is made up of the dark grayish brown surface layer of the Heiden soil which was eroded away.

Typically, the Heiden soil in this complex has a surface layer of dark grayish brown clay about 5 inches thick. The next layers are dark grayish brown clay to a depth of about 15 inches, grayish brown clay to a depth of 28 inches, and light olive brown clay to a depth of about 51 inches. The underlying material to to a depth of 74 inches is mottled, light brownish gray, olive brown, and gray shaly clay.

The soils in this complex are well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly, and when the soil is moist, it swells, the cracks close, and water enters very slowly. These soils have poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the heavy clay soil. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Altoga, Navo, and Seawillow soils. The included soils make up less than 10 percent of the map unit.

The soils in this complex are mainly used for pasture, but some areas are cultivated. These soils are well suited to use for pasture. Improved bermudagrass, switchgrass, kleingrass, johnsongrass, sweetclover, and vetch are commonly grown. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

These soils are moderately suited to use for crops. Grain sorghum, cotton, hay, and small grains are the main crops. Erosion has lowered the natural fertility in cultivated areas. Good management includes controlling erosion, maintaining tilth and fertility, and conserving soil moisture. Terracing and farming on the contour help to slow runoff. Grassed waterways are essential for stabilizing terrace outlets. Returning crop residue to the soil helps to improve tilth, control erosion, and conserve soil moisture. Growing deep-rooted, warm- or cool-season legumes helps to control erosion and maintain tilth and fertility.

The soils in this complex are poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and soil slippage are limitations. Good design and careful installation can partly overcome these limitations. These soils are poorly suited to use as septic tank absorption fields because of the very slow permeability.

These soils are poorly suited to most recreation uses. The main limitations are permeability, slope, and the clayey texture that causes the soil to form deep, wide cracks when dry and to become sticky when wet.

These soils are moderately suited to use as habitat for wildlife. This habitat is used by coyote, rabbits, quail, and doves.

This Ferris-Heiden complex is in capability subclass IVe. The Ferris soil is in the Eroded Blackland range site, and the Heiden soil is in the Blackland range site.

Fr—Frio silty clay, occasionally flooded. This deep, well drained, nearly level soil is in on flood plains of the major streams. This soil is flooded once every 3 to 5 years for brief periods. Slopes range from 0 to 1 percent. Areas are oblong and range from 10 to 150 acres.

Typically, the surface layer is very dark grayish brown silty clay about 18 inches thick. The next layer to a depth of 37 inches is dark grayish brown silty clay. The underlying material to a depth of about 60 inches is grayish brown silty clay that has limestone gravel in the upper part. This soil is calcareous throughout.

This soil is well drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is high. Flooding occurs occasionally, mostly in May and October. This soil has good tilth but can only be worked within a narrow range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Krum, Slidell, and Sunev soils. Also included is a loamy soil along the stream channel. The included soils make up less than 5 percent of the map unit.

This soil is used for crops and as rangeland. Small grains and forage sorghum are the main crops.

This soil is well suited to use for crops. It is mainly used for small grains, hay, and grain sorghum. Good management includes maintaining tilth and fertility. Deep-rooted legumes and crops that produce a large amount of residue help to maintain tilth and fertility.

This soil is well suited to use for pasture. It is well suited to improved bermudagrass, tall fescue, indiangrass, kleingrass, switchgrass, vetch, and singletary peas. Proper pasture management includes fertilizing, controlling weeds, and controlling grazing.

The hazard of flooding is the main limitation for urban uses. This soil is moderately suited to most recreation uses. The silty clay surface layer is the main limitation. Because of flooding, this soil is poorly suited to use as campsites.

This soil is well suited to use as habitat for wildlife. It provides excellent habitat for quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

This Frio soil is in capability subclass IIw and in the Loamy Bottomland range site.

GaB—Gasil loamy fine sand, 0 to 5 percent slopes. This deep, well drained, nearly level to gently sloping soil is on uplands. Slopes average about 2 percent. Areas are irregular in shape and range from 6 to 100 acres.

Typically, the surface layer is neutral loamy fine sand about 16 inches thick. It is brown in the upper part and light yellowish brown in the lower part. The upper part of the subsoil to a depth of 30 inches is slightly acid, brownish yellow sandy clay loam that has reddish yellow mottles; the middle part to a depth of 44 inches is strongly acid, yellow sandy clay loam that has dark red and strong brown mottles, and the lower part to a depth of 72 inches is strongly acid, coarsely and prominently mottled, yellowish brown, strong brown, and red sandy clay loam.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Crosstell and Silstid soils. Also included are small areas of Gasil soils that have a fine sandy loam surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture or crops.

This soil is moderately suited to use for crops, but low natural fertility and the medium available water capacity are limitations. A few small areas are used for melons, tomatoes, and fruit trees. Good management includes controlling soil blowing, conserving moisture, and maintaining fertility. Fertilizing, stripcropping, and growing crops that produce large amounts of residue help to control soil blowing, conserve moisture, and maintain fertility.

This soil is well suited to use for pasture. Improved bermudagrass, weeping lovegrass, switchgrass, indiangrass, vetch, and arrowleaf clover are adapted plants. Grass seedlings can be destroyed by blowing sand. Pasture management includes fertilizing at planned intervals throughout the growing season, controlling weeds, and controlling grazing.

This soil is well suited to most urban uses. Shrinking and swelling of the subsoil is the main limitation. Proper design and careful installation can overcome this limitation.

This soil is well suited to most recreation uses. The loamy fine sand surface soil blows when it is bare of vegetation and can be a limitation. Soil blowing can be overcome by maintaining a good grass cover.

This soil is well suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

This Gasil soil is in capability subclass IIIe and in the Loamy Sand range site.

GfB—Gasil fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average about 1.8 percent. Areas are irregular in shape and range from 5 to 30 acres.

The surface layer is slightly acid, brown fine sandy loam about 8 inches thick. The subsoil extends to a depth of 75 inches or more. The upper part is slightly acid to medium acid, brownish yellow sandy clay loam that has few fine distinct yellowish red mottles; the middle part is similar but has common fine and medium prominent red and brownish yellow mottles; and the lower part is medium acid, coarsely and prominently mottled yellowish brown, red, strong brown, and light gray sandy clay loam.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Crosstell, Hassee, Rader, and Silstid soils. Also included are small areas of a soil that is of redder hue but otherwise is similar to Gasil soils and a soil that is loamy in the upper part of the subsoil and clayey in the lower part. The included soils make up less than 15 percent of the map unit.

This Gasil soil is well suited to use for pasture (fig. 8). Improved bermudagrass and weeping lovegrass are the main pasture plants. Good management includes fertilizing, controlling weeds, and controlling grazing.

This soil is well suited to use for crops. Cotton, grain sorghum, and peanuts are mainly grown, but special crops, such as watermelons, cantaloupes, and vegetables, can be grown. Low fertility and the medium available water capacity limit production. Terracing and growing crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is well suited to most urban and recreation uses. Low strength is a limitation for streets and roads, but good design and careful installation can overcome this limitation. Septic tank absorption fields are moderately suited to this soil because of the permeability.

This soil is well suited to use as habitat for wildlife. Areas of this soil produce an abundance of woody and herbaceous plants that are excellent food and cover for deer, quail, and doves.

This Gasil soil is in capability subclass IIe and in the Sandy Loam range site.

GfC—Gasil fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on side slopes of uplands. Slopes average about 3.5 percent. Areas are irregular in shape and range from 10 to 30 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 9 inches thick. The subsoil extends to a depth of 70 inches or more. The upper part is strongly acid, brownish yellow sandy clay loam that has faint brownish mottles; the middle part is strongly acid, brownish yellow sandy clay loam that has common medium distinct red mottles; and the lower part is medium acid, yellow sandy clay loam that has many medium distinct red and very pale brown mottles.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Crosstell and Silstid soils. Also included are small areas of Gasil soils that have a loamy fine sand surface layer. The included soils make up less than 15 percent of the map unit.

This soil is well suited to use for pasture. Adapted species are improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover. Good management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. The main crops are peanuts and watermelons together with

Figure 8.—Cattle grazing on improved bermudagrass in a pecan orchard on Gasil fine sandy loam, 1 to 3 percent slopes.

grain sorghum and small grains. Slope, the hazard of erosion, the medium available water capacity, and low natural fertility are limitations. Terracing and contour farming help to slow runoff. Growing cover crops and returning crop residue to the soil help maintain tilth and reduce soil blowing and water erosion.

This soil is well suited to most urban uses. Low strength that affects streets and roads and the hazard of erosion are limitations, but proper design and careful installation can overcome these limitations. The moderate permeability is a limitation for use of this soil as septic tank absorption fields. This soil is well suited to most recreation uses. Slope is a limitation for playgrounds.

This soil is well suited to use as habitat for wildlife. Areas of this soil produce an abundance of woody and herbaceous plants that are excellent food and cover for deer, quail, and doves.

This Gasil soil is in capability subclass IIIe and in the Sandy Loam range site.

GfD4—Gasil fine sandy loam, 1 to 8 percent slopes, gullied. This deep, well drained, gently sloping to sloping soil is on uplands. Slopes average about 4 percent. Areas are irregular in shape and range from 5 to 50 acres.

About 6 to 10 percent of this map unit consists of U-shaped gullies that range from 40 to 180 feet apart. The gullies are 3 to 6 feet deep and 10 to 22 feet wide. The Gasil soils between the gullies have a surface layer of fine sandy loam or sandy clay loam. The Gasil soil and the gullies are not uniform and are not in a regular pattern.

Typically, the surface layer is neutral, yellowish brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 70 inches or more. The upper part is medium acid, mottled, brownish yellow sandy clay loam; the middle part is slightly acid, mottled, brownish yellow sandy clay loam; and the lower part is neutral, coarsely and prominently mottled, light brownish gray, yellowish brown, and red sandy clay loam.

This soil is well drained. Runoff is slow to medium. Permeability is moderate, and the available water capacity is medium. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Crosstell, Rader, and Silstid soils. Also included are areas of uneroded Gasil soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly as rangeland. In some areas the gullies have been graded and smoothed and the area has been sprigged with improved bermudagrass. This soil is poorly suited to improved pasture grasses. Grading and shaping the gullies and establishing grass are difficult and expensive undertakings.

This soil is poorly suited to crops. Most of the gullies cannot be crossed with farm machinery.

This soil is poorly suited to most urban and recreational uses. Gullies and some shrinking and swelling of the soil with changes in moisture are the main limitations. Slope is a limitation for use as playgrounds. The gullies are difficult and expensive to shape.

This soil is moderately suited to use as habitat for wildlife. Areas that do not have gullies provide good food and cover for quail, doves, and songbirds. Areas that have gullies furnish cover for rabbits, coyotes, foxes, raccoons, and bobcats.

This Gasil soil is in capability subclass VIe and in the Sandy Loam range site.

GuD—Gasil-Urban land complex, 1 to 8 percent slopes. This complex consists of deep, well drained, gently sloping to sloping Gasil soil and Urban land. It is on convex uplands. The area is elongated and follows the side slopes of hills. The area of this complex is 50 acres.

This complex is 40 to 70 percent Gasil soil, 15 to 30 percent Urban land, and 15 to 30 percent other soils. The Gasil soil and Urban land are so intricately mixed that mapping them separately was not practical.

Typically, the surface layer of the Gasil soil is neutral, brown fine sandy loam about 15 inches thick. The subsoil extends to a depth of 80 inches. It is medium acid, yellowish brown sandy clay loam in the upper part; strongly acid, brownish yellow sandy clay loam in the middle part; and strongly acid, brownish, reddish, and grayish sandy clay loam in the lower part.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is medium. The rooting zone is deep and is easily penetrated by plant roots.

Urban land consists of areas that are covered by dwellings, apartments, and small businesses, and adjoining streets, driveways, parking lots, and patios. These structures obscure or alter the soil properties so that classification of the soil is not feasible.

Included in mapping are small areas of Birome, Crosstell, and Rayex soils. The included soils make up 15 to 30 percent of the map unit.

This Gasil soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture content, slope, and the hazard of erosion are limitations, but good design and careful installation can overcome these limitations. Areas of the Gasil soil that do not have a vegetative cover can erode during construction if they are not protected by terraces or diversions and a grass or small grain cover.

This soil is well suited to recreation uses. In some places slope is a limitation for playgrounds. Woody plants provide food and cover for songbirds.

This Gasil-Urban land complex is not assigned to a capability subclass or to a range site.

Gw—Gowen clay loam, occasionally flooded. This deep, well drained, nearly level soil is on flood plains of small streams. This soil is flooded once every 3 to 5 years for brief periods, usually from March to May. Slopes range from 0 to 1 percent and average about 0.5 percent. Soil areas are long and narrow and range from 10 to 150 acres.

Typically, the surface layer is brown clay loam about 14 inches thick. The next layer to a depth of 29 inches is grayish brown clay loam that has thin strata of brown fine sandy loam. The underlying material to a depth of 60 inches is yellowish brown clay loam that has thin strata of dark grayish brown loam and pale brown fine sandy loam. This soil is neutral throughout.

This soil is well drained. Runoff is slow to medium. Permeability is moderate, and the available water capacity is high. This soil has fair tilth and can be worked within a wide range of moisture content. The rooting zone is deep and easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Pulexas, Pursley, and Tinn soils. Also included are areas of soil that have a calcareous, clayey surface layer about 10 inches thick. The included soils make up less than 15 percent of the map unit.

This soil is well suited to use for crops. The main crops are cotton, small grains, hay, and grain sorghum. Good management includes maintaining tilth and fertility. Deep-rooted legumes and crops that produce large amounts of residue help to maintain tilth and fertility.

This soil is well suited to pasture, and it is used mainly for native and improved pasture. Native vegetation consists of common bermudagrass and pecan, elm, and hackberry trees. Suitable pasture plants include improved bermudagrass, tall fescue, indiangrass, kleingrass, switchgrass, vetch, and singletary peas. Good management includes fertilizing, controlling weeds, and controlling grazing.

The hazard of flooding is the main limitation for urban uses. This soil is moderately suited to most recreation uses. Because of flooding, the soil is poorly suited to use as campsites.

This soil is well suited to use as habitat for wildlife. The area provides excellent habitat for quail, doves, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

This Gowen soil is in capability subclass IIw and in the Loamy Bottomland range site.

Gy—Gowen clay loam, frequently flooded. This deep, well drained, nearly level soil is on flood plains of streams. This soil is flooded 1 to 2 times a year for brief periods, usually from March to May. Slopes range from 0 to 1 percent and average about 0.5 percent. Areas are long and narrow. Some areas are 5 to 10 miles in length and range to as much as 250 yards in width. Areas range from 10 to 280 acres.

Typically, the surface layer is dark grayish brown clay loam about 20 inches thick. The layer below that is brown clay loam to a depth of 38 inches. The underlying material is light yellowish brown loam to a depth of 56 inches and dark grayish brown loam to a depth of 72 inches. This soil is neutral throughout.

This soil is well drained. Runoff is slow to medium. Permeability is moderate, and the available water capacity is high. This soil has fair tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Pulexas, Pursley, and Tinn soils. The included soils make up less than 15 percent of the map unit.

This soil is mainly used for pasture and pecan orchards, and it is well suited to these uses. Adapted pasture species are improved bermudagrass, tall fescue, switchgrass, johnsongrass, singletary peas, and arrowleaf clover. Good pasture management includes fertilizing, controlling weeds, and controlling grazing.

The hazard of flooding is the main limitation for crop use and for most urban and recreation uses. Installing a major flood control system is the only way to overcome this limitation.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil are inhabited by quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

This Gowen soil is in capability subclass Vw and in th Loamy Bottomland range site.

HaA—Hassee fine sandy loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on uplands. Slopes average about 0.8 percent. Areas are oval or irregular in shape and range from 6 to 270 acres.

Typically, the surface layer is neutral, dark grayish brown fine sandy loam about 9 inches thick. Below that is neutral, light gray fine sandy loam about 5 inches thick. The subsoil is neutral, dark grayish brown clay to a depth of 21 inches; mildly alkaline, dark gray clay to a depth of 37 inches; and moderately alkaline, grayish brown clay to a depth of 54 inches. The underlying material to a depth of 72 inches is moderately alkaline, distinctly mottled, light gray, grayish brown, yellowish brown, and strong brown clay.

This soil is somewhat poorly drained. Runoff is very slow to slow. Permeability is very slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. During wet seasons a perched high water table is above the clay lower layers. The rooting zone is deep, but root penetration is restricted by the clay layers. Soil blowing is a moderate hazard, and water erosion is a slight hazard.

Included in some areas of this soil are small areas of Culp, Rader, and Wilson soils. Also included are small areas of soils that have a browner A horizon than this Hassee soil and areas where the surface layer is more than 20 inches thick. The included soils make up less than 20 percent of the map unit.

This soil is mainly used for pasture, and it is moderately suited to this use. Improved bermudagrass, arrowleaf clover, and singletary peas are suitable pasture plants. Good management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. Seasonal wetness delays planting and harvesting. The dense, clayey subsoil releases moisture slowly to plant roots. Management includes improving tilth and maintaining fertility. Legumes and crops that produce large amounts of residue help to maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, occasional wetness, and the very slow permeability are the main limitations.

This soil is poorly suited to recreation uses. Wetness and the very slow permeability are the main limitations.

Figure 9.—Cotton and grain sorghum on Heiden clay, 1 to 3 percent slopes.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by doves and quail and by coyotes, rabbits, and skunks. During wet seasons, shallow water in some depressional areas provides food and rest areas for ducks.

This Hassee soil is in capability subclass IIIw and in the Claypan Prairie range site.

HeB—Heiden clay, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 6 to 1,900 acres.

Typically, the soil to a depth of 62 inches is clay. It is dark gray to a depth of about 5 inches, very dark grayish brown to about 14 inches, dark grayish brown to about 34 inches, and grayish brown to 62 inches. The underlying material to a depth of 80 inches or more is light yellowish brown shaly clay. This soil is moderately alkaline throughout.

This soil is well drained. Runoff is moderate. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly, and when the soil is wet, water enters very slowly. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is limited by the lower clay layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Culp, Ferris, Houston Black, and Navo soils. The included soils make up less than 10 percent of the map unit.

This soil is used mainly for crops.

This soil is well suited to use for crops. The main crops are cotton, grain sorghum, and small grains (fig. 9). Good management includes controlling erosion and maintaining tilth. Terracing, farming on the contour, and growing crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is well suited to use for pasture. Improved bermudagrass, kleingrass, switchgrass, tall fescue, and vetch are well adapted. Seedbeds are difficult to establish. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. Septic tank filter systems are poorly suited to this soil because of the very slow permeability.

This soil is moderately suited to recreation uses. The main limitations are the very slow permeability and the clay surface layer that is sticky when the soil is wet and that cracks when the soil is dry.

This soil is well suited to use as habitat for wildlife. The habitat is used by doves and quail. Grain crops and abundant forbs in the rangeland provide suitable food and cover.

This Heiden soil is in capability subclass IIe and in the Blackland range site.

HeD—Heiden clay, 3 to 8 percent slopes. This deep, well drained, gently sloping to sloping soil is on uplands. Slopes average about 3.5 percent. Areas are irregular in shape and range from 8 to 130 acres.

Typically, this soil is clay to a depth of 53 inches. It is dark gray to a depth of about 11 inches, dark grayish brown to 24 inches, grayish brown to 48 inches, and olive to 53 inches. The underlying material to a depth of 74 inches is mottled yellowish brown, gray, brownish yellow, and strong brown shaly clay. This soil is moderately alkaline throughout.

This soil is well drained. Runoff is rapid. When the soil is dry and cracked, water enters rapidly, but when the soil is wet, water enters very slowly. Permeability is very slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is limited by the clay subsoil. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Altoga, Ferris, Navo, and Seawillow soils. The included soils make up less than 10 percent of the map unit.

This soil is moderately suited to use for crops. Grain sorghum, small grains, and cotton are the main crops. Slope is a limitation. Good management includes controlling erosion and maintaining tilth. Terracing and contour farming are needed to slow runoff. Growing deep-rooted legumes and returning crop residue to the soil help to reduce erosion and maintain tilth.

This soil is moderately suited to use for pasture. Improved bermudagrass, indiangrass, switchgrass, johnsongrass, kleingrass, vetch, and sweetclover are suitable pasture plants. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the main limitations. Proper design and careful installation can only partly overcome these limitations.

This soil is moderately suited to most recreation uses. Limitations are the very slow permeability and the clay surface that cracks when the soil is dry and is sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by doves and quail. Grain crops provide suitable food.

This Heiden soil is in capability subclass IVe and in the Blackland range site.

HnB—Hensley clay loam, 1 to 3 percent slopes. This shallow, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 8 to 80 acres.

This soil has a surface layer of mildly alkaline, reddish brown clay loam about 5 inches thick. The subsoil to a depth of about 16 inches is mildly alkaline, red clay. The underlying material is indurated limestone bedrock that is slightly fractured.

This soil is well drained. Runoff is slow to moderate. Permeability is slow, and the available water capacity is very low. This soil has fair tilth and can be worked within a wide range of moisture content. Root penetration is restricted to the shallow depth to indurated limestone. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo and Lindale soils. Also included are soils that have a dark surface layer over indurated limestone. The included soils make up less than 10 percent of the map unit.

This soil is used mostly for crops. Small grains and forage sorghum are the main crops.

This soil is poorly suited to crops. The shallow root zone and the very low available water capacity are limitations for production. Deep plowing often brings up fragments of limestone. Cool-season crops are better suited to this soil than warm-season crops. Management includes controlling erosion, conserving moisture, and maintaining soil tilth and fertility. Growing closely spaced crops that produce large amounts of residue and returning the residue to the soil helps to control erosion, improve tilth, and conserve moisture. Growing cool-season legumes helps to maintain tilth and fertility.

This soil is moderately suited to use for pasture. The shallow depth to rock is a limitation for production. Kleingrass is a suitable pasture plant. Management includes fertilizing and controlling grazing.

This soil is poorly suited to most urban uses. Depth to rock is a limitation. Septic tank absorption systems are poorly suited to this soil.

This soil is poorly suited to most recreation uses. Depth to rock is the main limitation.

This soil is moderately suited to use as habitat for wildlife. The habitat is mainly used by quail, doves, and other birds. Brush cover is too sparse in most places to attract larger mammals.

This Hensley soil is in capability subclass IIIe and in the Redland range site.

HoA—Houston Black clay, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Soil areas are irregular in shape and range from 10 to 960 acres.

Typically, this soil is moderately alkaline clay to a depth of 80 inches or more. It is dark gray to a depth of about 6 inches, very dark gray to about 20 inches in dark gray to about 32 inches, and dark grayish brown to about 66 inches. Below that the soil is coarsely and distinctly mottled, dark gray, gray, yellowish brown, and light olive brown.

This soil is moderately well drained, and runoff is slow. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly, and when the soil is wet, water enters very slowly. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay in the lower layers. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Burleson, Heiden, Tinn, and Wilson soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. Cotton, grain sorghum, and small grains are the main crops, but other crops may be grown.

This soil is well suited to row crops and small grains. Returning crop residue to the soil and growing deep-rooted crops help to improve tilth and maintain the organic matter content (fig. 10).

This soil is well suited to use for pasture. Improved bermudagrass, tall fescue, johnsongrass, kleingrass, and singletary peas are well suited. Some areas are seasonally wet. If pasture is grazed when the surface is wet, the soil puddles. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are limitations. Proper design and careful installation can overcome these limitations.

This soil is moderately suited to recreation uses. Slow runoff, very slow permeability, and the clayey surface that becomes sticky when wet are limitations.

This soil is moderately suited to use as habitat for wildlife. Doves and quail regularly inhabit the area. Grain crops provide suitable food.

This Houston Black soil is in capability subclass IIw and in the Blackland range site.

HoB—Houston Black clay, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Soil areas are irregular in shape and range from 10 to 200 acres.

Typically, this soil is moderately alkaline clay to a depth of 72 inches or more. It is very dark gray to a depth of about 8 inches, dark gray to 34 inches, and dark grayish brown to 52 inches. Below that the soil is coarsely and distinctly mottled, grayish brown, dark grayish brown, light yellowish brown, and yellowish brown.

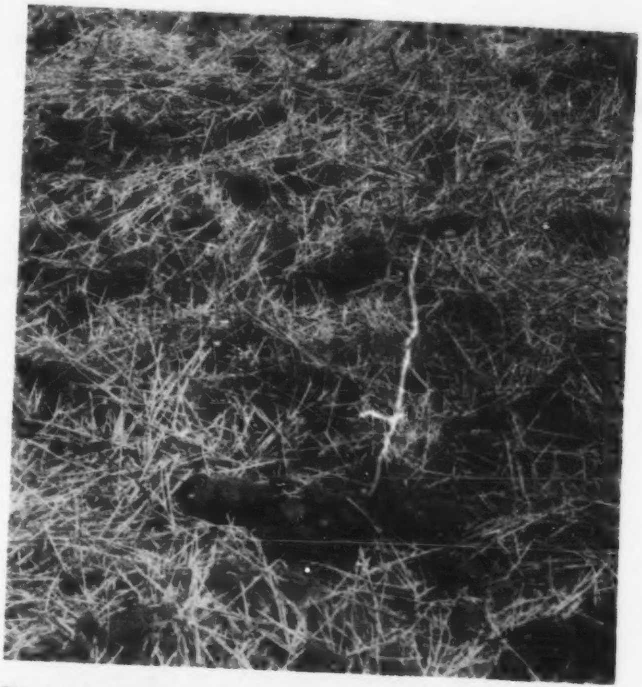


Figure 10.—Wheat residue on the surface of Houston Black clay, 0 to 1 percent slopes, helps to protect the soil from erosion.

This soil is moderately well drained, and runoff is moderate. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly, and when the soil is wet, water enters very slowly. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Burleson, Ferris, Heiden, Tinn, and Wilson soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. Cotton, grain sorghum, and small grains are the main crops.

Good management includes controlling erosion and maintaining tilth. Terracing and contour farming help to slow runoff and control erosion. Growing crops that produce large amounts of residue or growing deep-rooted legumes helps to control erosion, maintain tilth, and aerate the soil.

This soil is well suited to use for pasture. Improved bermudagrass, tall fescue, kleingrass, indiangrass, johnsongrass, and vetch are well suited. Some areas of the soil are seasonally wet, and seedbeds are difficult to prepare. Proper pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and low strength that affects streets and roads are limitations. Septic tank absorption fields are poorly suited to this soil because of the very slow permeability.

This Houston Black soil is moderately suited to recreation uses. Limitations are the very slow permeability and the clayey texture that causes deep, wide cracks when the soil is dry and stickiness on the surface when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by doves and quail. Grain crops provide suitable food.

This Houston Black soil is in capability subclass IIe and in the Blackland range site.

KrB—Krum silty clay, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on smooth valley fills. Slopes average about 1.5 percent. Areas are irregular in shape and range from 8 to 340 acres.

Typically, this soil is calcareous silty clay to a depth of 62 inches or more. It is dark grayish brown to a depth of about 6 inches, dark brown to about 34 inches, and brown to 52 inches. Below that, the soil is light brown.

This soil is well drained. Runoff is moderate. Permeability is moderately slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is hampered by the clay. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Bolar, Frio, Lewisville, Sanger, and Slidell soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as native rangeland and for pasture. Some acreage is used for crops. The soil produces high yields of forage.

This soil is well suited to improved bermudagrass, johnsongrass, kleingrass, switchgrass, vetch, and singletary peas. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is well suited to use for crops. Good management includes controlling erosion and maintaining tilth. Terracing, contour farming, growing crops that produce large amounts of residue, and growing deep-rooted legumes help to control erosion and maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the moderately slow permeability are the main limitations. Good design and careful installation partly overcome these limitations.

This soil is moderately suited to most recreation uses. The main limitations are the moderately slow permeability and the silty clay surface that cracks when the soil is dry and is sticky when the soil is wet.

This soil is well suited to use as habitat for wildlife. The habitat is preferred by quail and ground-nesting birds because of the suitable ground cover and food.

This Krum soil is in capability subclass IIe and in the Clay Loam range site.

KrC—Krum silty clay, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on valley fills on uplands. Slopes average about 3.5 percent. Areas are irregular in shape and range from 5 to 100 acres.

Typically, this soil is calcareous silty clay to a depth of 60 inches or more. It is dark grayish brown to a depth of about 5 inches, brown to about 22 inches, and yellowish brown to 42 inches. Below that the soil is brownish yellow.

This soil is well drained. Runoff is slow to rapid. Permeability is moderately slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is hampered by the heavy clay. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Bolar, Lewisville, Sanger, and Sunev soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as native rangeland and for pasture. Some acreage is used for crops. The soil produces moderate yields of native vegetation.

This soil is well suited to improved bermudagrass, johnsongrass, kleingrass, switchgrass, vetch, and singletary peas. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops, mainly small grains and forage sorghum. Good management includes controlling erosion and maintaining tilth. Terracing, contour farming, growing crops that produce large amounts of residue, and growing deep-rooted legumes help to control erosion and maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the moderately slow permeability are the main limitations. Good design and careful installation can partly overcome these limitations.

This soil is moderately suited to most recreation uses. The main limitations are the moderately slow permeability and the silty clay surface that cracks when the soil is dry and is sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by doves and ground-nesting birds.

This Krum soil is in capability subclass IIIe and in the Clay Loam range site.

LeB—Lewisville silty clay, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands.

Areas are irregular in shape and range from 8 to 150 acres.

Typically, this soil is moderately alkaline silty clay to a depth of 60 inches or more. It is brown silty clay to a depth of about 14 inches and brown silty clay that has many calcium carbonate concretions to a depth of 28 inches. Below that the soil is light yellowish brown silty clay that has about 10 percent, by volume, calcium carbonate concretions and soft masses.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture conditions. The rooting zone is deep, but root penetration is hampered by the clay lower layer. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Bolar, Frio, Krum, Sanger, and Slidell soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops. A few acres are used for pasture or as rangeland. Small grains and grain sorghum are the main crops.

This soil is well suited to improved bermudagrass, johnsongrass, kleingrass, switchgrass, vetch, and singletary peas. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is well suited to use for crops. Good management includes controlling erosion and maintaining tilth. Terracing, contour farming, growing crops that produce large amounts of residue, and growing deep-rooted legumes help to control erosion and maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and low strength that affects streets and roads are the main limitations. Proper design and careful installation can partially overcome these limitations.

This soil is moderately suited to most recreation uses. The main limitation is the silty clay surface that cracks when the soil is dry and is sticky when the soil is wet.

This soil is well suited to use as habitat for wildlife. This habitat is preferred by quail and ground-nesting birds because the ground cover and food are suitable.

This Lewisville soil is in capability subclass IIe and in the Clay Loam range site.

LeC—Lewisville silty clay, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 30 acres.

Typically, this soil is moderately alkaline silty clay to a depth of 60 inches or more. It is very dark grayish brown to a depth of about 8 inches and light brownish gray to a depth of 37 inches. Below that, the soil is pale brown silty clay that is about 30 percent, by volume, concretions and soft masses of calcium carbonate.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is hampered by the clay texture. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in some areas of this soil are small areas of Aledo, Bolar, Krum, Sanger, and Sunev soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops. Some acreage is used for pasture or as rangeland. Small grains and grain sorghum are the main crops.

This soil is well suited to improved bermudagrass, johnsongrass, kleingrass, switchgrass, vetch, and singletary peas. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is well suited to use for crops. Good management includes controlling erosion and maintaining tilth. Terracing, contour farming, growing crops that produce large amounts of residue, and growing deep-rooted legumes help to control erosion and maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and low strength that affects streets and roads are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is moderately suited to most recreation uses. The main limitation is the silty clay surface that cracks when the soil is dry and is sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The vegetation on this soil provides food for doves and other birds.

This Lewisville soil is in capability subclass IIIe and in the Clay Loam range site.

LIB—Lindale clay loam, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Slopes average about 1.8 percent. Areas are irregular in shape and range from 10 to 300 acres.

Typically, the surface layer is neutral, brown clay loam about 6 inches thick. The upper part of the subsoil to a depth of about 30 inches is mildly alkaline, reddish brown clay, and the lower part to a depth of about 35 inches is moderately alkaline, brown clay. The underlying material to a depth of 60 inches is moderately alkaline, strong brown clay that is about 70 percent, by volume, limestone gravel, cobbles, and stone.

This soil is well drained. Runoff is moderate. Permeability is slow, and the available water capacity is medium. This soil has fair tilth and can be worked within a limited range of moisture content. The rooting zone is moderately deep, but root penetration is restricted by the clay subsoil. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in some areas of this soil are small areas of Hensley, Lewisville, Ponder, and Sanger soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops, but some acreage is used for pasture. Forage sorghum and wheat are the main crops.

This soil is moderately suited to use for crops. Good management includes controlling erosion, maintaining fertility, and improving tilth. Farming on the contour and growing cool-season legumes and crops that produce large amounts of residue help to control erosion and maintain tilth.

This soil is moderately suited to use for pasture. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover are suitable pasture plants. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. Good design and careful installation can overcome these limitations. Septic tank absorption fields are poorly suited to this soil because of the slow permeability.

This soil is well suited to most recreation uses.

This soil is well suited to use as habitat for wildlife. The habitat is used by doves and quail. The wide variety of native plants provide suitable cover and seed.

This Lindale soil is in capability subclass IIIe and in the Deep Redland range site.

LnB—Lindale-Urban land complex, 1 to 3 percent slopes. This complex consists of Lindale soil and Urban land on convex ridges. The soil is moderately deep, well drained, and gently sloping. Areas are irregular in shape and range from 15 to 100 acres.

This complex is about 50 to 70 percent Lindale soil, 15 to 30 percent Urban land, and as much as 20 percent other soils. This soil and Urban land are so intricately mixed that mapping them separately was not practical.

Typically, the surface layer of Lindale soil is neutral, brown clay loam about 6 inches thick. The upper part of the subsoil to a depth of 30 inches is mildly alkaline, reddish brown clay, and the lower part to a depth of about 35 inches is moderately alkaline, brown clay. The underlying material to a depth of 60 inches is moderately alkaline, strong brown very gravelly clay that is about 70 percent, by volume, limestone gravel, cobbles, and stones.

This soil is well drained. Surface runoff is medium. Permeability is slow, and the available water capacity is medium. The rooting zone is moderately deep, but root penetration is restricted by the clay in the lower layers and gravel.

Urban land consists of areas of soil that are covered by dwellings, apartments, small businesses, schools, and adjoining streets, driveways, sidewalks, patios, and other structures. These structures obscure or alter the soil properties to the extent that classification of the soil is not feasible.

Included in mapping are small areas of Hensley and Ponder soils. The included soils make up about 20 percent of the map unit.

This Lindale soil is moderately suited to most urban uses. Low strength that affects roads and streets, the shrinking and swelling of the soil with changes in moisture content, corrosivity to uncoated steel, and depth to fragments of limestone are the main limitations. Proper design and careful installation help overcome these limitations. The slow permeability is a limitation for septic tank filter fields.

This soil is well suited to most recreation uses.

This Lindale-Urban land complex is not assigned to a capability subclass or to a range site.

LoB—Lott silty clay, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average 1.8 percent. Areas are circular or oval and range from 10 to 50 acres.

The surface layer is dark grayish brown silty clay about 9 inches thick. The upper part of the subsoil to a depth of 26 inches is light yellowish brown silty clay, and the lower part to a depth of 46 inches is pale yellow silty clay. The underlying material to a depth of 62 inches is very pale brown marly clay. This soil is calcareous throughout.

This soil is well drained. Surface runoff is medium. Permeability is moderately slow, and the available water capacity is high. This soil has fair tilth and can be worked within a narrow range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Lindale, Medlin, Ponder, and Sanger soils. The included soils make up less than 15 percent of the map unit.

This soil is mainly used for crops, and it is well suited to this use. Growing deep-rooted legumes and returning crop residue to the soil help to reduce erosion and improve soil tilth. Terracing and farming on the contour slow runoff and reduce erosion.

This soil is well suited to use for pasture. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and clover are suitable pasture plants. Management includes fertilizing to sustain high forage yields, controlling grazing to maintain adequate stubble height, and spraying or mowing to control weeds.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the moderately slow permeability are limitations. Proper design and careful installation can overcome these limitations.

This soil is moderately suited to recreation uses. The silty clay surface and the moderately slow permeability are the main limitations. Loamy fill material can help to overcome the stickiness of the surface during wet periods.

This soil is well suited to use as habitat for wildlife. The habitat is used by quail and ground-nesting birds because suitable ground cover and food are provided.

This Lott soil is in capability subclass IIe and in the Clay Loam range site.

LuB—Luckenbach clay loam, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is on geologic terraces of the Brazos and Nolan Rivers. Slopes average about 1.2 percent. Areas are irregular in shape and range from 10 to 150 acres.

Typically, the surface layer is mildly alkaline, brown clay loam about 13 inches thick. The subsoil to a depth of about 48 inches is moderately alkaline, reddish brown clay that has more carbonates in the lower 18 inches. The underlying material to a depth of 62 inches is calcareous, reddish yellow clay loam.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and the available water capacity is medium. This soil has fair tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clayey lower layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Krum and Sanger soils. Also included are small areas of soils that have a loam surface layer that is lighter in color than that of the Luckenbach soil, areas that are darker in color at a depth of more than 20 inches, and areas that are calcarous in the surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mostly for crops. Small grains and forage sorghum are the main crops grown.

This soil is well suited to use for crops. Good management includes controlling erosion and maintaining tilth by terracing, growing crops that produce large amounts of residue, and growing deep-rooted legumes.

This soil is well suited to use for pasture. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, arrowleaf clover, and vetch are suitable pasture plants. Fertilizing, controlling weeds, and controlling grazing are needed for high yields.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. Septic tank absorption fields are poorly suited to this soil because of the moderately slow permeability.

This soil is well suited to most recreation uses.

This soil is well suited to use as habitat for wildlife. Areas of this soil are preferred by quail and ground-nesting birds because excellent ground cover and food are provided.

This Luckenbach soil is in capability subclass IIe and in the Clay Loam range site.

MeE—Medlin clay, 5 to 15 percent slopes. This deep, well drained, gently sloping to moderately steep soil is on uplands. Slopes average about 6 percent. Areas are irregular in shape and range from 8 to 20 acres. In undisturbed areas, the surface is ridges and swales that are oriented up and down the slope. These ridges and swales are destroyed after a few years of cultivation.

Typically, this soil is calcareous, moderately alkaline clay to a depth of 44 inches. It is dark grayish brown clay to a depth of 11 inches, olive clay that has intersecting slickensides to a depth of 28 inches, and light olive brown clay below that. The underlying material to a depth of 60 inches is moderately alkaline, mottled, light olive brown and pale olive shaly clay.

This soil is well drained. Runoff is rapid. Permeability is very slow, and the available water capacity is high. The rooting zone is deep, but root penetration is restricted by the clay. This soil has poor tilth and can be worked within a narrow range of moisture conditions. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Birome, Crosstell, Lott, and Sanger soils. The included soils make up less than 10 percent of the map unit.

This soil is used mainly as rangeland. Yields of native tall and mid grasses are moderate.

This soil is poorly suited to use for pasture, crops, or urban purposes. Slope, the severe hazard of erosion, the shrinking and swelling of the soil with changes in moisture, the very slow permeabilty, and corrosivity to uncoated steel are limitations. Soil slippage is likely to occur if deep cuts are made across the slope.

This soil is moderately suited to most recreation uses. The clay surface, slope, and the very slow permeability are limitations.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by doves and quail. Deer from the adjacent woods use the abundant supply of forbs for food.

This Medlin soil is in capability subclass VIe and in the Eroded Blackland range site.

MnB—Minwells fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on old geologic terraces. Slopes average about 1.5 percent. Areas are irregular in shape and range from 6 to 140 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 7 inches thick. The upper part of the subsoil to a depth of 30 inches is slightly acid, red sandy clay; the middle part to a depth of 48 inches is neutral, red sandy clay; and the lower part to a depth of 62 inches is mildly alkaline, yellowish red gravelly sandy clay loam.

This soil is well drained. Runoff is medium. Permeability is slow, and the available water capacity is medium. This soil has fair tilth and can be worked witnin a wide range of moisture content. The rooting zone is deep, but root penetration is restricted by gravelly material in the lower layers. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Aledo, Bastrop, Bolar, Callisburg, Hassee, and Paluxy soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for pasture. A few acres are used for crops, such as grain sorghum and peanuts. Improved bermudagrass and lovegrass are the main grasses.

This soil is well suited to use for pasture. Adapted pasture plants are improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover. Good management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. Low natural fertility and droughtiness of the clayey subsoil are limitations. Good management includes controlling soil blowing and water erosion, conserving moisture, and maintaining tilth and fertility by terracing and farming on the contour. Returning crop residue to the soil helps to control soil blowing and to conserve moisture. Growing cool-season legumes helps maintain tilth and fertility and control erosion.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. Septic tank absorption fields are poorly suited to this soil because of slow permeability. Proper design and careful installation can overcome these limitations.

This soil is well suited to recreational uses.

This soil is well suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, doves, and turkeys.

This Minwells soil is in capability subclass IIe and in the Sandy Loam range site.

MnC2—Minwells fine sandy loam, 2 to 5 percent slopes, eroded. This deep, well drained, gently sloping soil is on high geologic terraces. Areas are irregular in shape and range from 6 to 58 acres.

Typically, the surface layer is neutral, brown fine sandy loam about 5 inches thick. The upper part of the subsoil to a depth of about 18 inches is slightly acid, red sandy clay; to a depth of 28 inches is neutral, red sandy clay that has common fine distinct yellowish brown and yellowish red mottles; to a depth of 40 inches is neutral, red sandy clay that has common medium faint yellowish red mottles; and to a depth of 55 inches is neutral, reddish yellow sandy clay that has a few fine faint yellowish mottles. The lower part of the subsoil to a depth of 60 inches is neutral, reddish yellow sandy clay loam.

This soil is well drained. Runoff is medium. Permeability is slow, and the available water capacity is medium. This soil has fair tilth and can be worked within a medium range of moisture content. The rooting zone is deep, but root penetration is restricted by the gravelly material in the lower layers. Eroded areas of this soil have undergone sheet erosion and occasional shallow rill erosion. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Bastrop and Callisburg soils. Also included are small areas of a soil that has a concentration of calcium carbonate at a depth of 35 to 50 inches and areas of a soil that has beds of gravel at a depth of 24 inches. The included soils make up less than 20 percent of the map unit.

This soil is used mostly as rangeland, but a few acres are used for improved pasture. Yields of tall and mid grasses are high.

This soil is moderately suited to use for pasture. Low natural fertility and rapid runoff are limitations. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, vetch, and arrowleaf clover are adapted plants. Good pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. Good management includes controlling water erosion and soil blowing and maintaining tilth and fertility. Terracing and farming on the contour help to slow runoff and control water erosion. Growing crops that produce large amounts of residue and returning crop residue to the soil help to control soil blowing and water erosion and help to conserve moisture. Growing cool-season legumes helps to maintain tilth and fertility.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, slope, corrosivity to uncoated steel, and the slow permeability are the main limitations. Areas that are not covered with vegetation during construction are subject to severe erosion. Proper design and careful installation can overcome these limitations.

This soil is moderately suited to recreation uses. The hazard of severe erosion and slope are the main limitations. A vegetative cover is needed to prevent erosion.

This soil is well suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, doves, and turkeys.

This Minwells soil is in capability subclass IIIe and in the Sandy Loam range site.

NaC—Navo clay loam, 2 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average about 2.5 percent. Areas are irregular in shape and range from 6 to 70 acres.

Typically, the surface layer is slightly acid, brown clay loam about 5 inches thick. The upper part of the subsoil to a depth of about 15 inches is slightly acid, reddish brown clay; to a depth of about 34 inches is medium acid, yellowish brown clay that has red, yellowish brown, and brownish yellow mottles; and to a depth of 44 inches is slightly acid, prominently mottled yellowish brown, brownish yellow, light brownish gray, and grayish brown clay. The lower part of the subsoil to a depth of 62 inches is moderately alkaline, brownish yellow clay that has yellowish brown, dark grayish brown, and grayish brown mottles.

This soil is well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture conditions. The rooting zone is deep, but root penetration is restricted by the clay. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Burleson, Crosstell, Heiden, and Wilson soils. Also included are areas of soils that have had the surface layer removed by erosion. In these areas the clay subsoil is exposed. The included soils make up less than 30 percent of the map unit.

This soil is mainly used for pasture and crops. It is well suited to pasture. Improved bermudagrass, kleingrass, vetch, weeping lovegrass, indiangrass, and arrowleaf clover are suitable pasture plants. Fertilizer should be applied to maintain yields.

This soil is moderately suited to use for crops. Terracing and contour farming are needed to reduce erosion. Returning crop residue to the soil helps to slow runoff and improves soil tilth. Growing deep-rooted legumes helps to aerate the soil and maintain tilth.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the main limitations. This soil is moderately suited to recreation uses. The very slow permeability is the main limitation.

This soil is moderately suited to use as habitat for wildlife. This habitat is used mainly by doves and quail, coyotes, rabbits, bobcats, and skunks. Ample food is furnished by the abundance of forbs.

This Navo soil is in capability subclass IVe and in the Claypan Prairie range site.

NwB—Navo-Wilson complex, 0 to 3 percent slopes. This complex consists of moderately well drained Navo soil and somewhat poorly drained Wilson soil. These deep, loamy soils are on uplands. Slopes average about 1.5 percent. Areas are irregular in shape and range from 10 to 80 acres.

The Navo soil makes up about 60 percent of this complex, the Wilson soil about 25 percent, and other soils about 15 percent. These soils are so intricately mixed that mapping them separately was not practical.

Typically, the Navo soil has a slightly acid, brown clay loam surface layer about 6 inches thick. The subsoil is clay. To a depth of 13 inches, it is slightly acid and yellowish red; to a depth of 28 inches, slightly acid and strong brown; to a depth of 46 inches, neutral and light brownish gray; and to a depth of 62 inches, moderately alkaline and distinctly mottled yellowish brown, light gray, and yellowish red.

Permeability is very slow in the Navo soil, and surface runoff is medium. The available water capacity is high. This soil has fair tilth and can be worked within a medium range of moisture conditions. The rooting zone is deep, but root penetration is restricted by the clay in the lower layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

The Wilson soil has a surface layer of neutral, dark grayish brown silty clay loam about 7 inches thick. The subsoil is silty clay. To a depth of 22 inches it is neutral and dark gray; to a depth of 38 inches it is mildly alkaline and very dark grayish brown; to a depth of 57 inches it is mildly alkaline and light brownish gray; and to a depth of 62 inches it is moderately alkaline and pale brown.

Permeability is very slow in the Wilson soil, and surface runoff is very slow to medium. The available water capacity is medium. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay in the lower layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in this complex are small areas of Burleson, Crosstell, Ferris, and Heiden soils. The included soils make up less than 25 percent of the map unit.

The Navo and Wilson soils are well suited to pasture. Improved bermudagrass, kleingrass, vetch, weeping lovegrass, indiangrass, and arrowleaf clover are suitable pasture plants. Fertilizer should be applied to maintain the yields.

These soils are moderately suited to use for crops. Terracing and contour farming are needed to reduce erosion. Returning crop residue to the soil helps to slow runoff and improve soil tilth. Growing deep-rooted legumes helps to aerate the soil and maintain tilth.

These soils are poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the main limitations. These soils are poorly suited to recreational uses. The very slow permeability and wetness are the main limitations.

These soils are moderately suited to use as habitat for wildlife. The habitat is used mainly by doves, quail, coyotes, rabbits, bobcats, and skunks. Ample food for songbirds is furnished by the wide variety of forbs.

This Navo-Wilson complex is in capability subclass IIIe and in the Claypan Prairie range site.

PaB—Paluxy very fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces adjacent to the Brazos River flood plain. Slope averages about 1.2 percent. Areas are elongated and parallel to the flood plain and range from 25 to 95 acres.

Typically, the surface layer is slightly acid, brown very fine sandy loam about 8 inches thick. The upper part of the subsoil is neutral, reddish brown very fine sandy loam to a depth of 32 inches, and the lower part is mildly alkaline, yellowish red very fine sandy loam to a depth of 46 inches. The underlying material to a depth of 62 inches is moderately alkaline, reddish yellow very fine sandy loam.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid, and the available water capacity is high. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Bastrop, Decordova, and Minwells soils. Also included are areas of soils on short steep slopes along terrace edges. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. The main crop is peanuts.

This soil is well suited to use for crops. Good management includes preventing soil blowing and maintaining tilth and fertility by growing cool-season legumes and returning crop residue to the surface.

This soil is well suited to use for pasture. Improved bermudagrass, weeping lovegrass, kleingrass, switchgrass, arrowleaf clover, and vetch are suitable pasture plants. Good management includes controlling weeds, fertilizing, and controlling grazing.

This soil is well suited to most urban and recreation uses. Limitations are easily overcome.

This soil is well suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, doves, and turkeys.

This Paluxy soil is in capability subclass IIe and in the Sandy Loam range site.

Pb—Pits. These miscellaneous areas consist of pits that have been excavated during the mining of limestone, gravel, or sand. These pits are throughout the county. They range from about 4 acres to 250 acres and are mainly rectangular to oblong in shape. About 800 acres in the county is delineated as pits.

Limestone quarries, which are the largest pits, are in the western part of the county. These pits are open excavations from which limestone is removed to be used as agricultural lime or as road material. These pits range to as much as 250 acres or more. The limestone pits have vertical walls about 20 feet deep. These quarries are mainly on the Aledo, Bolar, and Purves soils.

Gravel pits are along the Brazos River, Camp Creek, and the Nolan River. The gravel is used as road and building material. These pits range from 10 to 20 acres. Average depth is about 12 feet. These pits are mostly on the Bastrop, Lindale, Luckenbach, and Paluxy soils.

Sand pits are smaller pits in the county. They are open excavations from which sand was dug to be used for building material and fill material. These pits range to 45 acres but average about 10 acres. Average depth is about 8 feet. These sand pits are mostly on the Gasil and Silstid soils.

These pits are poorly suited to most uses. Some limestone pits hold water and could provide habitat for fish and waterfowl. Some of the sand pits could be smoothed, revegetated, and used as habitat for wildlife.

Pits were not assigned to a capability subclass or to a range site.

PnB—Ponder clay loam, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Slopes average about 2 percent. Areas are irregular in shape and range from 8 to 50 acres.

Typically, the surface layer is slightly acid, brown clay loam about 5 inches thick. The upper part of the subsoil to a depth of about 15 inches is neutral, brown clay. The next layer to a depth of 35 inches is mildly alkaline, brown clay that has common reddish mottles. Below that to a depth of 40 inches is moderately alkaline, grayish brown clay that has common reddish mottles. The lower part of the subsoil to a depth of 60 inches or more is moderately alkaline, pale brown clay loam.

This soil is moderately well drained. Surface runoff is medium. Permeability is slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay in the lower layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Crosstell, Culp, Lindale, Medlin, Sanger, and Wilson soils. Also included are areas of soils that are eroded. The included soils make up less than 20 percent of the map unit.

This soil is well suited to use for crops, but the clayey subsoil releases moisture slowly causing the soil to be somewhat droughty. Grain sorghum and small grains are grown on this soil. Good management includes controlling erosion and maintaining fertility and tilth by returning crop residue to the soil. Terracing and contour farming help to reduce erosion.

This soil is well suited to use for pasture. Improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover are suitable pasture plants. Fertilizer is needed to maintain production.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the slow permeability are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is moderately suited to recreation uses. Slow permeability is the main limitation. Using loamy fill material and maintaining a good grass cover help to overcome these limitations.

This soil is moderately suited to use as habitat for wildlife. The habitat is preferred by quail and ground-nesting birds because the ground cover and food are suitable.

This Ponder soil is in capability subclass IIIe and in the Claypan Prairie range site.

PnC—Ponder clay loam, 3 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Slopes average about 3.8 percent. Areas are in narrow bands on foot slopes and range from 6 to 100 acres.

Typically, the surface layer is neutral, brown clay loam about 5 inches thick. The subsoil to a depth of about 18 inches is neutral, reddish brown clay; to a depth of 32 inches is mildly alkaline, brown clay that has reddish mottles; to a depth of 44 inches is moderately alkaline, yellowish brown clay that has reddish mottles; and to a depth of 50 inches is moderately alkaline, reddish yellow clay that has reddish and yellowish mottles. The underlying material to a depth of 62 inches is moderately alkaline, reddish yellow clay loam that has reddish mottles.

This soil is moderately well drained. Surface runoff is medium. Permeability is slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the dense clay in the lower layers. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Crosstell, Gasil, Medlin, and Sanger soils. Also included are areas of steep soils that have no surface layer material because of erosion. The included soils make up less than 25 percent of the map unit.

This soil is used mainly as rangeland. It produces moderate yields of forage.

This soil is poorly suited to use for crops because of slope and the clayey subsoil that releases moisture slowly and causes the soil to be somewhat droughty. Forage sorghum and small grains are grown on this soil. Good management includes controlling erosion and maintaining fertility and tilth. Returning crop residue to the soil helps to conserve moisture and improve tilth. Terracing and contour farming help to reduce erosion.

This soil is moderately suited to use for pasture. Improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, and arrowleaf clover are suitable pasture plants. Fertilizer is needed to maintain production.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and slow permeability are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is moderately suited to recreation uses. Slope and slow permeability are the main limitations. Using loamy fill material and maintaining a good grass cover help to overcome these limitations.

This soil is moderately suited to use as habitat for wildlife. The habitat is preferred by quail and ground-nesting birds because of the ground cover and food.

This Ponder soil is in capability subclass IVe and in the Claypan Prairie range site.

PoB—Ponder-Urban land complex, 1 to 3 percent slopes. This complex consists of deep, gently sloping Ponder soil and Urban land. The Ponder soil is on low, convex uplands. Areas are irregular in shape and range from 30 to 1,500 acres.

About 50 to 70 percent of the complex is Ponder soil, 15 to 40 percent Urban land, and 15 percent other soils. The Ponder soil and Urban land are so intricately mixed that mapping them separately was not practical.

Typically, the surface layer of the Ponder soil is slightly acid, brown clay loam about 5 inches thick. The subsoil to a depth of 40 inches is clay. It is neutral and brown in the upper part, mildly alkaline and brown in the middle part, and moderately alkaline and grayish brown in the lower part. The underlying material to a depth of 60 inches is moderately alkaline, pale brown clay.

This soil is moderately well drained. Runoff is medium. Permeability is slow, and the available water capacity is high. The rooting zone is deep, but root penetration is restricted by the clayey lower layers.

Urban land consists of areas that are covered by individual dwellings, apartments, small businesses, industrial sites, railroad shops and yards, churches, schools, and adjoining streets, driveways, sidewalks, and parking lots. These structures obscure or alter soil properties to the extent that classification of the soil is not feasible.

Included in mapping are small areas of Culp, Lindale, Sanger, and Wilson soils. The included soils make up as much as 15 percent of the map unit.

The Ponder soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, low strength that affects roads and streets, corrosivity to uncoated steel, and the slow permeability are limitations. Proper design and careful installation can partly overcome these limitations.

This soil is moderately suited to most recreation uses. Slow permeability is the main limitation.

This Ponder-Urban land complex is not assigned to a capability subclass or to a range site.

Pp—Pulexas fine sandy loam, frequently flooded. This deep, well drained, nearly level soil is on flood plains of small streams. Most areas of this soil are flooded one to several times a year for brief periods. Areas are long and narrow in shape and range from about 10 acres to 350 acres.

Typically, this soil is fine sandy loam that is brown to a depth of 56 inches and dark brown to a depth of 65 inches or more. The surface layer to a depth of 12 inches is neutral; other layers are mildly alkaline.

This soil is well drained. Surface runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a medium hazard.

Included in mapping are small areas of Gowen and Pursley soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and as native rangeland. Improved bermudagrass is the main pasture grass.

This Pulexas soil is well suited to use for pasture. Improved bermudagrass, switchgrass, singletary peas, arrowleaf clover, and vetch are suitable pasture plants. Fertilizing, controlling grazing, and controlling weeds are needed to maintain high forage yields.

This soil is poorly suited to use for crops and for urban and recreation purposes because of the hazard of flooding. This limitation can be overcome only by the installation of a major flood control system.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by quail, doves, deer, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

This Pulexas soil is in capability subclass Vw and in the Loamy Bottomland range site.

Pr—Pursley clay loam, frequently flooded. This deep, well drained, nearly level soil is on flood plains of small streams. This soil is flooded on the average of once each year for a brief period. Slopes range from 0 to 1 percent and average about 0.5 percent. Areas are long and narrow and range from 10 to 150 acres.

Typically, this soil is moderately alkaline clay loam to a depth of 60 inches or more. It is dark grayish brown to a depth of 18 inches, grayish brown to 36 inches, and brown to 48 inches. Below that it is pale brown.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is high. This soil has fair tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Gowen, Pulexas, Rader, and Tinn soils. Also included are areas of soils that have a calcareous clay surface layer about 10 inches thick. The included soils make up less than 15 percent of the map unit.

This soil is well suited to pasture. Adapted pasture species are improved bermudagrass, lovegrass, kleingrass, fescue, and singletary peas. Concerns in management are controlling grazing to maintain the adequate stubble height, fertilizing to replace soil nutrients, and spraying or mowing to control weeds.

This soil is poorly suited to use for crops because of the flooding hazard. This limitation can be overcome only by the installation of a major flood control system.

This soil is well suited to use as habitat for wildlife. The habitat is used by quail, doves, squirrels, and raccoons. Many songbirds frequent the area for food, cover, and nesting.

This soil is not suited to most urban and recreation uses because of the flooding hazard.

This Pursley soil is in capability subclass Vw and in the Loamy Bottomland range site.

PuB—Purves clay, 1 to 3 percent slopes. This shallow, well drained, gently sloping soil is on broad, plane to slightly convex areas on ridgetops. Areas are irregular in shape and range from 5 to 60 acres.

Typically, the surface layer is dark grayish brown, calcareous clay about 7 inches thick. Below that to a depth of about 14 inches is dark grayish brown, calcareous clay that is about 55 percent, by volume, fragments of limestone ranging from 1 inch to 4 inches across the long axis. The underlying material is indurated, fractured limestone.

This soil is well drained. Surface runoff is slow to moderate. Permeability is moderately slow, and the available water capacity is very low. This soil has fair tilth and can be worked within a narrow range of moisture content. The rooting zone is shallow, and root penetration is restricted by the limestone bedrock. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included is mapping are small areas of Aledo, Bolar, and Denton soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as rangeland, but a few acres are used for crops.

This soil is moderately suited to use for crops. Small grains and hay are the main crops. Such crops are better suited to this soil than warm-season crops because of the very low available water capacity and droughtiness. Good management includes controlling erosion and maintaining soil tilth and fertility. Growing closely spaced crops or crops that produce large amounts of residue in rotation with cool-season legumes helps to control erosion and maintain soil tilth.

This soil is moderately suited to use for pasture. Droughtiness limits production. Improved bermudagrass and kleingrass are commonly grown pasture plants. Management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Depth to limestone, shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the moderately slow permeability are the main limitations. In most areas the limestone bedrock can be excavated without the use of explosives. Proper design and careful installation can overcome some limitations.

This soil is poorly suited to most recreational uses. The clay surface is sticky when the soil is wet and cracks when the soil is dry. The shallow depth to limestone is an additional limitation.

This soil is moderately suited to habitat for wildlife. The habitat is preferred by quail and doves for food and cover.

This Purves soil is in capability subclass IIIe and in the Shallow range site.

PuC—Purves clay, 3 to 5 percent slopes. This shallow, well drained, gently sloping soil is on side slopes below limestone hills. Areas are long, narrow bands or irregular in shape and range from 10 to 60 acres.

Typically, the surface layer is dark grayish brown, calcareous clay about 6 inches thick. Below that to a depth of 12 inches is dark grayish brown, calcareous clay that has a few fragments of limestone. The next layer is grayish brown, calcareous clay that is approximately 50 percent, by volume, fragments of limestone as much as 3 inches thick. The underlying material is indurated fractured limestone.

This soil is well drained. Runoff is moderate. Permeability is moderately slow, and the available water capacity is very low. This soil has fair tilth and can be worked within a narrow range of moisture content. The rooting zone is shallow; root penetration is restricted by the limestone bedrock. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo, Bolar, Denton, and Sunev soils. Also included are small areas of soils that have a noncalcareous surface layer but otherwise are similar to the Purves soil. The included soils make up less than 20 percent of the map unit.

This soil is used mainly as rangeland. It produces moderate yields of high quality forage.

This soil is poorly suited to use for pasture. Improved bermudagrass and kleingrass are adapted grasses. Concerns in management are controlling grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or mowing to control weeds.

This soil is poorly suited to use for crops. Cool-season crops are better suited to this soil than warm-season crops because of the very low available water capacity and droughtiness. Good management includes controlling erosion and maintaining soil tilth and fertility. Growing closely spaced crops or crops that produce large amounts of residue in rotation with cool-season legumes helps control erosion and maintain soil tilth.

This soil is poorly suited to most urban and recreational uses. Depth to rock, shrinking and swelling of the soil with changes in moisture, and high corrosivity are the main limitations.

This soil is moderately suited to use as habitat for wildlife. The habitat is used by quail and doves for food and cover.

This Purves soil is in capability subclass IVe and in the Shallow Range site.

RaB—Rader fine sandy loam, 0 to 3 percent slopes. This deep, moderately well drained, nearly level to gently sloping soil is in low flat areas and at the bottom of foot slopes. Slopes average about 1.5 percent. Areas are irregular in shape and range from 10 to 150 acres.

Typically, the surface layer is slightly acid, brown fine sandy loam about 4 inches thick. The subsurface layer is slightly acid fine sandy loam that is light yellowish brown to a depth of 10 inches and pale brown to a depth of 16 inches. The layer below that to a depth of 27 inches is medium acid, light yellowish brown sandy clay loam. The subsoil to a depth of 38 inches is strongly acid, light gray clay; to a depth of 53 inches is medium acid, coarsely and prominently mottled light gray, brownish yellow, and dark red clay; to a depth of 64 inches is slightly acid, light gray sandy clay loam; and to a depth of 72 inches is slightly acid, yellow sandy clay loam.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep, but root penetration is restricted by the clayey lower layers. During wet seasons a perched water table is above the clayey lower layers. Soil blowing is a moderate hazard, and water erosion is a slight hazard.

Included in mapping are small areas of Crosstell, Gasil, Gowen, Hassee, and Pulexas soils. The included soils make up about 15 percent of the map unit.

This soil is mainly used for pasture, and it is well suited to this use. Improved bermudagrass, kleingrass, weeping lovegrass, switchgrass, vetch, singletary peas, and arrowleaf clover are adapted plants. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is well suited to use for crops. Low natural fertility and the rapid loss of moisture during the summer are limitations for production. Terracing and contour farming are needed to control erosion in areas where the slope exceeds 1 percent. Returning crop residue to the soil and growing deep-rooted legumes help to slow runoff and maintain soil tilth.

This soil is moderately suited to most urban uses. Seasonal wetness, shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel and concrete, and the very slow permeability are the main limitations. Some low-lying areas near drainageways are flooded by runoff from adjacent higher areas. Proper design and careful installation are needed to overcome these limitations.

This soil is moderately suited to recreation uses. Seasonal wetness and the very slow permeability are the main limitations.

This Rader soil is well suited to use as habitat for wildlife. Areas of this soil furnish an abundance of woody and herbaceous plants that provide excellent food and cover for deer, quail, and doves.

This Rader soil is in capability subclass IIIs and in the Sandy Loam range site.

RdB—Rader-Urban land complex, 0 to 3 percent slopes. This complex consists of Rader soil and Urban land in a shallow valley. The nearly level to gently sloping soil is deep and moderately well drained. The area is irregular in shape and is 275 acres.

This complex is 50 to 65 percent Rader soil, 15 to 35 percent Urban land, and less than 20 percent other soils. The Rader soil and Urban land are so intricately mixed that mapping them separately was not practical.

Typically, the surface layer of the Rader soil is slightly acid fine sandy loam about 16 inches thick. It is brown in the upper part, light yellowish brown in the middle part, and pale brown in the lower part. The subsoil to a depth of 27 inches is medium acid, light yellowish brown sandy clay loam and to a depth of 72 inches is mottled in shades of gray, yellow, and red. It is medium acid to strongly acid clay in the upper part and slightly acid sandy clay loam in the lower part.

This soil is moderately well drained. Permeability is very slow, and the available water capacity is medium. Surface runoff is slow. A perched water table is above the clayey layers after periods of heavy rainfall. The rooting zone is deep, but plant roots have difficulty penetrating the clayey lower layers.

Urban land consists of areas that are covered by individual dwellings and small businesses and adjoining streets, sidewalks, driveways, parking lots, and patios. These obscure or alter the soil properties to the extent that classification of the soil is not feasible.

Included in mapping are small areas of Crosstell, Gasil, and Hassee soils. The included soils make up less than 20 percent of the map unit.

This Rader soil is moderately suited to most urban uses. Seasonal wetness, shrinking and swelling of the soil with changes in moisture content, corrosivity to uncoated steel, and very slow permeability are the main limitations. Some low-lying areas of the soil near drainageways are flooded by runoff from adjacent soils in higher positions. Proper design and careful installation are needed to overcome these limitations.

This soil is moderately suited to recreational uses. Seasonal wetness and the very slow permeability are the main limitations. Woody plantings provide food and cover for songbirds.

This complex is not assigned to a capability subclass or to a range site.

SaB—Sanger clay, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average about 1.8 percent. Areas are irregular in shape and range from 10 to 100 acres. In undisturbed areas the surface is characterized by microrelief that consists of ridges and swales (fig. 11). The ridges are 3 to 12 inches higher than the bottom of the swales and are oriented up and down the slope. The ridges and swales are not evident after a few years of cultivation.

Typically, the surface layer in the center of a swale is very dark grayish brown clay about 8 inches thick. Below that to a depth of 37 inches is dark grayish brown clay. To a depth of 60 inches the soil is brown clay that has yellowish mottles, and to a depth of 72 inches it is light yellowish brown clay that has olive brown mottles. The underlying material to a depth of 80 inches or more is yellow shaly clay. This soil is moderately alkaline throughout.

This soil is well drained. Surface runoff is slow to medium. When this soil is dry, it has wide, deep cracks, and water enters the soil rapidly, but when it is wet, the cracks close and water enters the soil slowly. Permeability is very slow, and the available water capacity is high. The rooting zone is deep, but root penetration is restricted by the clay texture. This soil has poor tilth and can be worked within a narrow range of moisture content. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Denton, Krum, Purves, and Slidell soils. Also included are small areas of a soil that has shaly clay at a depth of less than 40 inches but otherwise is similar to the Sanger soil. The included soils make up less than 15 percent of the map unit.

This soil is mainly used for crops, but a significant acreage is used for pasture and as rangeland.

This soil is well suited to use for crops. It is mainly used for grain sorghum, cotton, small grains, and forage sorghum. Good management includes controlling erosion and maintaining tilth. Terracing and farming on the contour help to slow runoff and to control erosion.

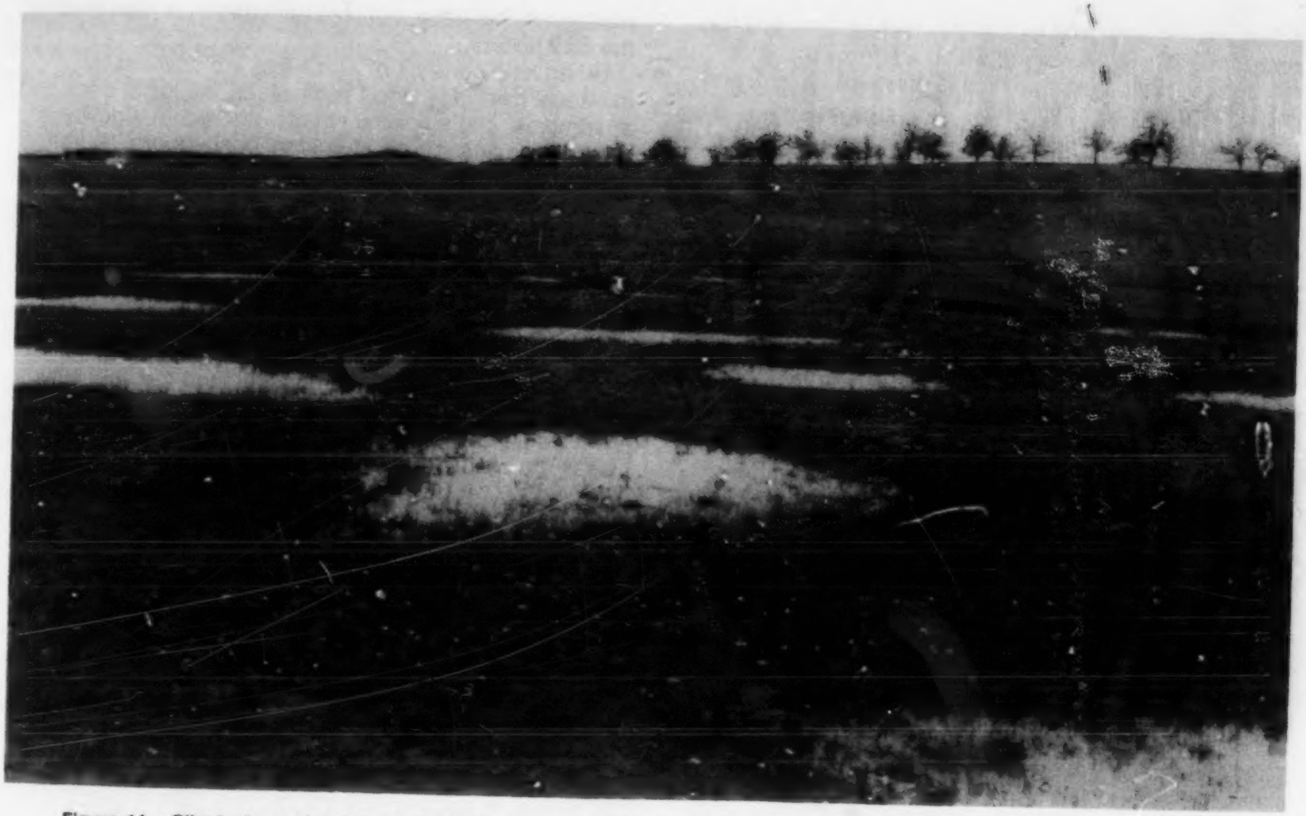


Figure 11.—Gilgai microrelief showing water in microdepressions in an undisturbed area of Sanger clay, 1 to 3 percent slopes.

Returning crop residue to the soil helps to improve soil tilth and conserve moisture.

This soil is well suited to use for pasture. Suitable pasture species are improved bermudagrass, tall fescue, johnsongrass, kleingrass, vetch, and sweetclover. Fertilizing, controlling weeds, and controlling grazing help maintain forage yields.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. Proper design and careful installation can partly overcome these limitations. This soil is poorly suited to use as septic tank absorption fields because of the very slow permeability.

This soil is moderately suited to most recreation uses. The main limitations are the very slow permeability and the clay surface layer that forms deep, wide cracks when it is dry and becomes sticky when it is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is used mainly by doves and quail. Deer from adjacent woods use the abundant supply of forbs for food.

This Sanger soil is in capability subclass IIe and in the Blackland range site.

SaC—Sanger clay, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average about 4 percent. Areas are irregular in shape and range from 10 to 50 acres.

Typically, the surface layer is dark grayish brown clay about 8 inches thick. Below that is dark grayish brown clay to a depth of 19 inches. To a depth of 31 inches the soil is light olive brown clay that has a few faint yellowish mottles, and to a depth of 49 inches it is light brownish gray clay that has common fine distinct light olive brown mottles. The underlying material is mottled grayish brown and light brown shaly clay to a depth of 62 inches or more.

This soil is well drained. Surface runoff is medium. When dry, this soil has wide deep cracks that extend to depths of more than 20 inches, and water enters the soil rapidly. When wet, the cracks close and water enters the soil slowly. Permeability is very slow, and available water capacity is high. The rooting zone is deep, but root penetration is restricted by the clay texture. This soil has poor tilth and can be worked within a narrow range of moisture content. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Aledo, Bolar, Krum, Purves, and Slidell soils. Also included are small areas of soils in which the shaly clay is at depths of less than 40 inches. The included soils make up less than 15 percent of the map unit.

This soil is moderately suited to use for crops. It is used for grain sorghum, small grains, and hay. Slope is a limitation. Good management includes controlling erosion and maintaining tilth by growing deep-rooted legumes and returning crop residue to the soil. Terracing and contour farming are needed to slow runoff and control erosion.

This soil is well suited to use for pasture. Improved bermudagrass, indiangrass, switchgrass, johnsongrass, kleingrass, vetch, and sweetclover are suitable pasture plants. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the main limitations. Good design and careful installation can only partly overcome these limitations.

This soil is moderately suited to most recreation uses. The limitations are the very slow permeability and the clay surface that cracks when the soil is dry and becomes sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is regularly used by doves and quail. Deer from adjacent woods use the abundant supply of forbs for food.

The Sanger soil is in capability subclass IIIe and in the Blackland range site.

SbC—Sanger-Urban land complex, 1 to 5 percent slopes. The soil is deep, well drained, and gently sloping. Areas are irregular in shape and range from 30 to 400 acres. Slopes average about 2 percent.

This complex is about 50 to 70 percent Sanger soil, 15 to 30 percent Urban land, and about 20 percent other soils. The Sanger soil and Urban land are so intricately mixed that mapping them separately was not practical.

Typically, the Sanger soil to a depth of 37 inches is very dark grayish brown clay in the upper part and dark grayish brown clay in the lower part. To a depth of 72 inches the soil is brownish clay that has yellowish mottles. The underlying material is yellow shaly clay. This soil is moderately alkaline throughout.

This soil is well drained. Surface runoff is slow to medium. When dry, this soil has wide, deep cracks and water enters the soil rapidly. When wet, the cracks close and water enters the soil slowly. Permeability is very slow, and the available water capacity is high. The rooting zone is deep, but root penetration is restricted by the clay texture.

Urban land consists of areas that are covered by individual dwellings, small businesses, industrial sites, apartments, and adjoining streets, driveways, sidewalks, and parking lots. These structures obscure or alter the soil properties to the extent that classification of the soil is not feasible.

Included in mapping are small areas of Burleson, Ponder, Slidell, and Wilson soils. The included soils make up about 20 percent of the map unit.

This Sanger soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture content, low strength that affects roads and streets, corrosivity to uncoated steel, and the very slow permeability are limitations that are difficult to overcome.

This soil is moderately suited to most recreational uses. The clay texture and the very slow permeability are limitations.

This Sanger-Urban land complex is not assigned to a capability subclass or to a range site.

SeC—Seawillow clay loam, 1 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average about 4 percent. Areas are irregular in shape and range from 10 to 30 acres.

This soil has a surface layer of calcareous, grayish brown clay loam about 8 inches thick. The subsoil to a depth of about 24 inches is calcareous, light yellowish brown clay loam. The underlying material to a depth of 60 inches or more is calcareous, very pale brown loam.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is high. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Bolar, Brackett, Lewisville, and Sunev soils. The included soils make up less than 20 percent of the map unit.

This soil is mainly used as rangeland. Some acreage, however, is used for small grains and forage sorghum.

This soil is moderately suited to crops. Concerns in management include returning residue to the soil, timely or limited tillage, and rotation of crops. Terracing and contour farming are needed to help slow runoff, control water erosion, and conserve moisture. Crop residue helps to maintain soil productivity.

This soil is moderately suited to pasture. Improved bermudagrass, kleingrass, vetch, and sweetclover are suited to this soil. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is moderately suited to most urban uses. Shrinking and swelling of the soil with changes in moisture content and low strength that affects roads and streets are limitations, but proper design and careful installation can easily overcome these limitations. This soil is well suited to most recreation uses. Sites for playgrounds, however, are limited because of slope.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil have suitable vegetation for food and cover for deer, turkeys, quail, and doves.

This Seawillow soil is in capability subclass IIIe and in the Clay Loam range site.

SeE—Seawillow clay loam, 5 to 12 percent slopes. This deep, well drained, sloping to strongly sloping soil is on uplands. Slopes average about 7 percent. Areas are irregular in shape and range from 6 to 50 acres.

Typically, this soil has a surface layer of brown clay loam about 7 inches thick. The subsoil to a depth of 33 inches is brownish yellow clay loam. The underlying material to a depth of 60 inches or more is brownish yellow loam that has light gray mottles. This soil is moderately alkaline throughout.

This soil is well drained. Surface runoff is medium to rapid. Permeability is moderate, and the available water capacity is high. The rooting zone is deep and easily penetrated by plant roots. Soil blowing is a slight hazard, and water erosion is a severe hazard.

Included in mapping are small areas of Altoga, Bolar, Brackett, Ferris, Lewisville, and Sunev soils. The included soils make up about 25 percent of the map unit.

This soil is used mainly as rangeland. Tall and mid grasses are the main native plants. Some areas of this soil are used as pasture.

This soil is poorly suited to improved grasses, such as bermudagrass, lovegrass, or kleingrass. Concerns in management are proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or mowing to control weeds.

This soil is poorly suited to crops because of the steep slopes.

This soil is moderately suited to most urban and recreation uses. Low strength that affects roads and streets, shrinking and swelling of the soil with changes in moisture content, and slope are limitations. Proper design and careful installation can overcome these limitations.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil have suitable vegetation for food and cover for deer, turkeys, quail, and doves.

This Seawillow soil is in capability subclass VIe and in the Clay Loam range site.

SfB—Silstid loamy fine sand, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes average about 2 percent. Areas are irregular in shape and range from 10 to 30 acres.

Typically, the surface layer is neutral, pale brown loamy fine sand about 14 inches thick. Below that to a depth of about 26 inches is neutral, very pale brown loamy fine sand. The upper part of the subsoil to a depth of 39 inches is slightly acid, brownish yellow sandy clay loam that has few fine faint reddish mottles; the middle part to a depth of 57 inches is slightly acid, yellow sandy clay loam that has few medium distinct yellowish red mottles; and the lower part to a depth of 80 inches or more is slightly acid, coarsely and prominently mottled, very pale brown, brownish yellow, and red sandy clay loam.

This soil is well drained. Runoff is slow. Permability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Crosstell and Gasil soils. The included soils make up less than 20 percent of the map unit.

This soil is used almost equally for pasture and crops. It is well suited to use for pasture. Improved bermudagrass, weeping lovegrass, switchgrass, indiangrass, vetch, and arrowleaf clover are commonly grown. Emerging seedlings can be protected from blowing sand by a dead-litter cover or an applied mulch. Proper pasture management includes fertilizing at planned intervals throughout the growing season, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. The main crop is peanuts. A few small areas are used for corn, melons, tomatoes, fruit trees, and nursery stock. The low natural fertility and medium available water capacity are limitations. Concerns in management are controlling soil blowing, conserving moisture, and maintaining fertility by stripcropping. Growing crops that produce large amounts of residue and fertilizing are additional needs.

This Silstid soil is well suited to most urban uses. Corrosivity to uncoated steel and concrete is the main limitation. Proper design and careful installation can overcome the limitation.

This soil is moderately suited to most recreation uses. The loamy fine sand surface soil that blows when the soil is bare is the main limitation. Soil blowing can be overcome by maintaining a good grass cover.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide suitable cover and some food for deer, quail, doves, and squirrels.

This Silstid soil is in capability subclass IIIs and in the Sandy range site.

SfD—Silstid loamy fine sand, 3 to 8 percent slopes. This deep, well drained, gently sloping to sloping soil is on uplands. Slopes average about 5 percent. Areas are irregular in shape and range from 5 to 30 acres.

Typically, the surface layer is slightly acid, light yellowish brown loamy fine sand about 10 inches thick.

Below that to a depth of 28 inches is slightly acid, very pale brown loamy fine sand. The upper part of the subsoil to a depth of 38 inches is medium acid, yellowish brown sandy clay loam; the middle part to a depth of 50 inches is medium acid, brownish yellow sandy clay loam that has a few faint yellowish red mottles; and the lower part to a depth of 61 inches is medium acid, brownish yellow sandy clay loam that has common medium prominent red mottles. The underlying material to a depth of 74 inches or more is slightly acid, mottled red, brownish yellow, light gray, and strong brown sandy clay loam that has ironstone gravel in places.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Crosstell and Gasil soils. The included soils make up less than 20 percent of the map unit.

This Silstid soil is used mainly for pasture and crops. It is well suited to use for pasture. Improved bermudagrass, vetch, and arrowleaf clover are commonly grown. Emerging seedlings can be protected from blowing sand by a dead-litter cover or an applied mulch. Proper management includes fertilizing at planned intervals throughout the growing season, controlling weeds, and controlling grazing.

This soil is moderately suited to use for crops. A few small areas are used for corn, peanuts, melons, tomatoes, and fruit trees. The low natural fertility and medium available water capacity are limitations. Concerns in management are controlling soil blowing, conserving moisture, and maintaining fertility by stripcropping. Growing crops that produce large amounts of residue and fertilizing are additional needs.

This soil is well suited to most urban uses. Corrosivity to uncoated steel and concrete is the main limitation. Proper design and careful installation can overcome this limitation.

This soil is moderately suited to most recreation uses. The loamy fine sand surface soil that blows when the soil is bare is the main limitation. Soil blowing can be overcome by maintaining a good grass cover.

This soil is moderately suited to use as habitat for wildlife. Areas of this soil have an abundance of woody and herbaceous plants that provide food and cover for deer, squirrels, quail, and doves.

This Silstid soil is in capability subclass IIIe and in the Sandy range site.

SlA—Slidell clay, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on uplands. Slopes average about 0.8 percent. Areas are irregular in shape and range from 15 to 50 acres.

Typically, the surface layer is dark gray clay about 5 inches thick. Below that to a depth of 30 inches, the soil is very dark gray clay; to a depth of 52 inches, it is dark grayish brown clay that has yellowish mottles; to a depth of 64 inches, it is grayish brown clay that has yellowish brown and brownish yellow mottles; and to a depth of 72 inches or more, it is light brownish gray clay that has yellow and brownish yellow mottles. This soil is calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly, and when the soil is moist, water enters very slowly. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Burleson, Frio, Krum, and Sanger soils. The included soils make up less than 15 percent of the map unit.

This soil is mainly used for crops. It is well suited to this use. Cotton, grain sorghum, and small grains are the main crops. Concerns in management are maintaining tilth and fertility. Growing deep-rooted legumes and crops that produce large amounts of residue helps to maintain tilth.

This soil is well suited to use for pasture. Suitable pasture species are improved bermudagrass, tall fescue, switchgrass, kleingrass, johnsongrass, vetch, and sweetclover. Good pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is moderately suited to most recreation uses. The main limitations are the very slow permeability and the clay surface layer that forms deep, wide cracks when the soil is dry and becomes sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is mainly used by doves and quail. Deer occasionally use these areas for food, but there is no woody growth for cover.

This Slidell soil is in capability subclass IIw and in the Blackland range site.

SlB—Slidell clay, 1 to 3 percent slopes. This deep, well drained, sloping soil is on uplands. Slopes are dominantly about 1.8 percent. Soil areas are irregular in shape and range from 6 to 50 acres. In undisturbed areas the surface is characterized by gilgai microrelief consisting of microknolls and microdepressions. The highest parts of the microknolls range from 4 to 12 inches above the lowest part of the microdepressions. They are 6 to 10 feet across and from 10 to 20 feet apart. Cultivation for a few years smoothes the relief.

Typically, in the center of the microdepressions the surface layer is very dark gray clay about 6 inches thick. The next layer to a depth of about 45 inches is dark gray clay. Below that to a depth of 60 inches is grayish brown clay that has faint yellowish and brownish mottles and to a depth 72 inches is light brownish gray clay that has distinct yellowish and brownish mottles. The underlying material to a depth of 80 inches is light brownish gray shaly clay.

This soil is well drained. Surface runoff is slow to medium. Permeability is very slow, and the available water capacity is high. When the soil is dry and cracked, water enters rapidly and when the soil is moist, the cracks close and water enters very slowly. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Denton, Frio, Krum, Purves, and Sanger soils. Also included are small areas of Slidell soils that have slopes of 0 to 1 percent. The included soils make up less than 15 percent of the map unit.

This soil is mainly used for crops, and it is well suited to this use. Grain sorghum and small grains are the main crops, but corn, cotton, and forage sorghum are also grown. Concerns in management are controlling erosion and maintaining tilth. Terracing and farming on the contour help to slow runoff and to control erosion. Growing deep-rooted legumes helps maintain tilth. Returning crop residue to the soil helps to conserve moisture and to slow runoff.

This soil is well suited to use for pasture. Improved bermudagrass, kleingrass, johnsongrass, vetch, and sweetclover are adapted plants. Proper pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture and corrosivity to uncoated steel are the main limitations. This soil is poorly suited to use as septic tank absorption fields because of the very slow permeability. Good design can only partly overcome these limitations.

This soil is moderately suited to recreation uses. The main limitations are the very slow permeability and the clayey surface layer that cracks when the soil is dry and becomes sticky when the soil is wet.

This soil is moderately suited to use as habitat for wildlife. The habitat is used mainly by doves and quail. Deer occasionally use these areas for food, but the soil lacks woody growth for cover.

This Slidell soil is in capability subclass IIe and in the Blackland range site.

SuB—Sunev clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on terraces along small streams. Slopes average about 1.5 percent. Areas are long and narrow and range from 6 to 64 acres.

Typically, this soil is calcareous clay loam to a depth of 62 inches or more. The surface layer is dark grayish brown to a depth of about 16 inches. The subsoil is brown to a depth of about 26 inches and light yellowish brown to a depth of about 44 inches. The underlying material is brown.

This soil is well drained. Surface runoff is slow to medium. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Bolar, Frio, Krum, and Seawillow soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for pasture or as rangeland. Improved bermudagrass and kleingrass are the main grasses. Native rangeland vegetation furnishes large yields of high quality forage.

This soil is moderately suited to row crops and small grains. Forage sorghum, grain sorghum, and small grains are the main crops. The medium available water capacity causes stress for crops during extended dry periods. Good management includes terracing and contour farming to slow runoff and reduce erosion. Returning crop residue to the soil helps to control erosion and maintain soil tilth.

This soil is well suited to use for pasture. Improved bermudagrass, kleingrass, johnsongrass, weeping lovegrass, indiangrass, switchgrass, sweetclover, and vetch are commonly grown. Fertilizing, controlling weeds, and controlling grazing are management practices needed for high yields.

This soil is well suited to most urban uses. Low strength that affects streets and roads is the main limitation. Proper design and careful installation can overcome this limitation. Sewage lagoons are poorly suited to this soil because of seepage.

This soil is well suited to most recreation uses. The clay loam surface layer is the main limitation. Using loamy fill material and maintaining a good grass cover can help to overcome this limitation.

This soil is well suited to use as habitat for wildlife. Areas of this soil provide excellent ground cover for ground-nesting birds.

This Sunev soil is in capability subclass IIe and in the Clay Loam range site.

SuC—Sunev clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping upland soil is on foot slopes below limestone hills. Slopes average about 3.8 percent. Areas are irregular in shape and range from 8 to 40 acres.

Typically, this soil is calcareous clay loam to a depth of 62 inches or more. The surface layer is dark grayish brown to a depth of about 12 inches. The subsoil is brown to a depth of about 23 inches and pale brown to a depth of about 44 inches. The underlying material is pale yellow. It increases in content of calcium carbonate as depth increases.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is medium. This soil has good tilth and can be worked within a wide range of moisture content. The rooting zone is deep and easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Included in some areas of this soil are small areas of Bolar, Krum, Purves, Sanger, and Seawillow soils. The included soils make up less than 20 percent of the map unit.

This soil is dominantly used as rangeland. It furnishes large amounts of high quality forage.

This soil is well suited to use for pasture. Adapted pasture species are improved bermudagrass, kleingrass, indiangrass, switchgrass, sweetclover, and vetch. Good management includes controlling weeds, fertilizing, and controlling grazing.

This soil is moderately suited to use for crops. Slope, the severe hazard of erosion, and the high content of lime in the subsoil are the main limitations. Management includes controlling erosion, improving soil tilth, and conserving soil moisture by terracing and farming on the contour. Grassed waterways are needed for terrace outlets. Growing closely spaced crops that produce large amounts of residue and returning crop residue to the soil help to slow runoff, improve tilth, and conserve soil moisture.

This soil is well suited to most urban and recreation uses. Slope, the hazard of erosion, and low strength that affects streets and roads are the main limitations. Seeding grass on construction sites and using proper design and careful installation help to overcome these limitations. The clay loam surface, which becomes sticky when the soil is wet, is a limitation for recreation uses. Slope is a limitation for the use of this soil for playgrounds.

This soil is well suited to use as habitat for wildlife. The habitat is preferred by quail and ground-nesting birds because the ground cover and food supply are excellent. Deer, turkeys, and doves also use the area.

This Sunev soil is in capability subclass IIIe and in the Clay Loam range site.

Tn—Tinn clay, frequently flooded. This deep, somewhat poorly drained, nearly level soil is on flood plains of streams. This soil is flooded more frequently than once every 2 years. Slopes range from 0 to 1 percent but average about 0.5 percent. Areas are long and narrow and range from 10 to 150 acres.

Typically, the surface layer is dark gray clay about 18 inches thick. Below that the soil is very dark gray clay to a depth of about 42 inches and gray clay to a depth of 60 inches or more. This soil is moderately alkaline throughout.

This soil is somewhat poorly drained. Surface runoff is very slow. Permeability is slow, and the available water capacity is high. This soil is subject to flooding from once to several times each year for brief periods, usually from March to May. The rooting zone is deep, but root penetration is restricted by the dense clay texture. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Gowen, Pulexas, and Pursley soils. Also included are soils that are browner than those typical of the Tinn series. These soils are in transitional areas between Blackland Prairie soils and East Cross Timber soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture, and it is well suited to this use. Adapted pasture plants commonly grown are improved bermudagrass, tall fescue, indiangrass, switchgrass, kleingrass, johnsongrass, sweetclover, and singletary peas. Good management includes fertilizing, controlling weeds, and controlling grazing.

The hazard of flooding is the main limitation to use for crops and for urban and recreation uses. This limitation can be overcome only by installation of a major flood control system. Other limitations are wetness, the very slow permeability, and the clay texture throughout. This soil forms deep, wide cracks when the soil is dry and becomes sticky when the soil is wet.

Areas of this soil are well suited to use as habitat for wildlife. This soil has good cover and food for songbirds, quail, doves, rabbits, squirrels, raccoons, and bobcats.

This Tinn soil is in capability subclass Vw and in the Clayey Bottomland range site.

Us—Ustorthents, loamy. These deep, loamy soils are in pits from which gravel and sand were excavated. When these pits were excavated, the original soil material and about 12 to 16 feet of loamy and clayey overburden were removed to expose the gravel below. The original soil material and overburden were mixed during excavation and left in piles in the pits (fig. 12). In low areas of these soils, runoff is ponded. Reclaiming the soil for agricultural or industrial uses is not practical, but some areas have been smoothed and revegetated. Slopes range from 5 to 100 percent. The areas are rectangular and range from 5 to 240 acres. Ongoing excavating operations are enlarging some areas.

These soils are extremely variable in content. They are stratified in texture and color but are made up of mainly loamy material. Colors are in shades of red, brown, or yellow. These soils have varying amounts of sand and gravel.

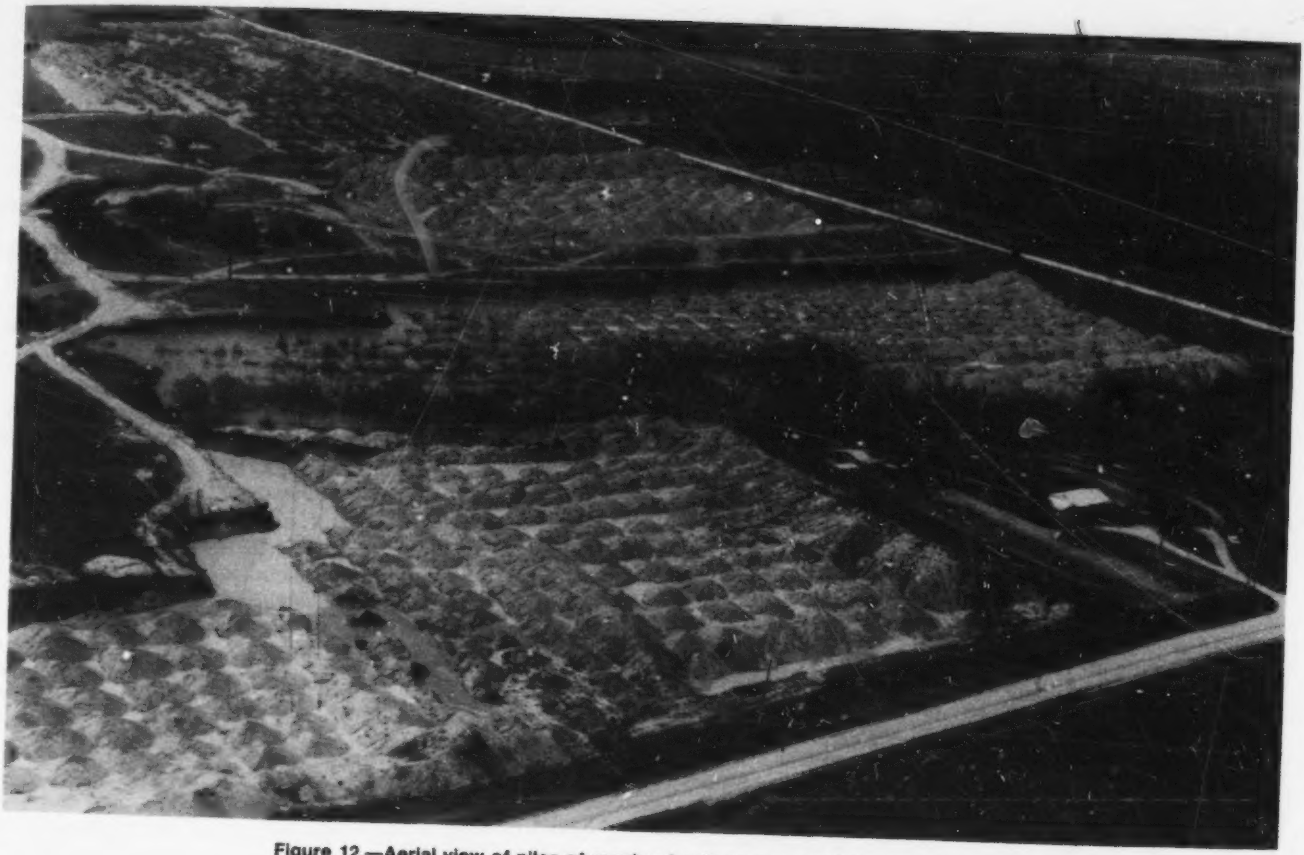


Figure 12.—Aerial view of piles of overburden in an area of Ustorthents, loamy.

Included in mapping are small pits. In places these pits contain water. Also included are islands and fingers of the Bastrop and Luckenbach soils.

These soils are idle or are used as habitat for wildlife. These soils are suitable for pasture, rangeland, and wildlife. Grading and smoothing are necessary before grass can be planted. If these soils are not smoothed and are left idle, the soils naturally revegetate with annual weeds and willow and cottonwood trees. In places the soils in the low-lying positions impound water that is used by wildlife.

These soils are not suited to crops. They are poorly suited to recreational uses.

These Ustorthents soils are in capability subclass VIIe. They are not assigned to a range site.

WsA—Wilson silty clay loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on uplands or low terraces. Slopes average about 0.5 percent. Areas are irregular in shape and range from 10 to 80 acres.

Typically, the surface layer is slightly acid, dark grayish brown silty clay loam about 7 inches thick. The subsoil to a depth of 66 inches is silty clay. It is neutral and dark gray in the upper part, neutral and dark grayish brown in the middle part, and mildly alkaline and grayish brown in the lower part. The underlying material is moderately alkaline, mottled light brownish gray and grayish brown silty clay to a depth of 72 inches or more.

This soil is somewhat poorly drained. Surface runoff is very slow. Permeability is very slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay in the lower layers. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Burleson, Hassee, Heiden, and Navo soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops. Some acreage is used for improved pasture.

This soil is moderately suited to use for crops. The main crops are grain sorghum, cotton, and small grains. Surface crusting and droughtiness are limitations for production. Good management includes conserving moisture, maintaining tilth, and maintaining fertility. Surface drainage may be needed in a few areas. Growing crops that produce large amounts of residue and returning crop residue to the soil help to maintain tilth and fertility.

This soil is well suited to use for pasture, but seedbed preparation is difficult because of surface crusting and rapid changes in surface moisture conditions. Improved bermudagrass, kleingrass, arrowleaf clover, and singletary peas are commonly grown. Livestock grazing when the soil is wet causes soil compaction. Pasture management includes fertilizing, controlling weeds, and controlling grazing.

This soil is poorly suited to most urban uses. Shrinking and swelling of the soil with changes in moisture, seasonal wetness, corrosivity to uncoated steel, and the very slow permeability are the main limitations. Proper design and careful installation can partly overcome these limitations.

This soil is poorly suited to most recreation uses. The main limitations are seasonal wetness, the very slow permeability, and the clay loam surface that becomes sticky when the soil is wet. Grading, installing proper drainage, and maintaining a good grass cover help to overcome these limitations.

This soil is moderately suited to use as habitat for wildlife. This habitat is used mainly by doves and quail, together with coyotes, rabbits, bobcats, and skunks. Ample food for songbirds is provided by the wide variety of forbs.

This Wilson soil is in capability subclass IIIw and in the Claypan Prairie range site.

WsB—Wilson silty clay loam, 1 to 3 percent slopes. This deep, somewhat poorly drained, gently sloping soil is on uplands or terraces. Slopes average about 1.8 percent. Areas are irregular in shape and range from 8 to 20 acres.

Typically, the surface layer is neutral, dark grayish brown silty clay loam about 6 inches thick. The subsoil to a depth of 57 inches is silty clay. It is neutral and very dark gray in the upper part, mildly alkaline and dark grayish brown in the middle part, and mildly alkaline and light brownish gray in the lower part. The underlying material to a depth of 72 inches or more is moderately alkaline, very pale brown silty clay that has brownish yellow mottles.

This soil is somewhat poorly drained. Surface runoff is very slow to medium. Permeability is very slow, and the available water capacity is high. This soil has poor tilth and can be worked within a narrow range of moisture content. The rooting zone is deep, but root penetration is restricted by the clay texture in the lower layers. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Burleson, Culp, Hassee, Heiden, and Navo soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops. Some acreage is used for improved pasture.

This soil is moderately suited to cultivated crops, such as cotton and grain sorghum, because of the hard, crusty surface and clay in the lower layers. If this soil is cultivated, water erosion is a hazard. Leaving crop residue on the surface when crops are not grown, and using minimum tillage, terraces, and contour farming help conserve the soil and maintain productivity.

This soil is well suited to pasture plants, such as improved bermudagrass, kleingrass, lovegrass, and vetch. Concerns in management are proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or mowing to control weeds.

This soil is poorly suited to most urban and recreation uses. Wetness, low strength that affects roads and streets, the slow permeability, corrosivity to uncoated steel and concrete, and the shrinking and swelling of the soil with changes in moisture are limitations that are difficult to overcome.

This soil is moderately suited to use as habitat for wildlife. The habitat is used mainly by doves, quail, rabbits, coyotes, skunks, and raccoons. Ample food for songbirds is provided by a variety of forbs.

This Wilson soil is in capability subclass IIIe and in the Claypan Prairie range site.

WuB—Wilson-Urban land complex, 0 to 2 percent slopes. This complex consists of Wilson soil and Urban land in low, concave areas of uplands. This soil is deep, somewhat poorly drained, and nearly level to gently sloping. Areas are irregular in shape and range from 10 to 100 acres.

This complex is 45 to 65 percent Wilson soil, 15 to 40 percent Urban land, and less than 20 percent other soils. The Wilson soil and Urban land are so intricately mixed that mapping them separately was not practical.

Typically, the surface layer of the Wilson soil is slightly acid, dark grayish brown silty clay loam about 7 inches thick. The subsoil to a depth of 66 inches is silty clay. It is neutral and dark gray in the upper part, neutral and dark grayish brown in the middle part, and mildly alkaline and grayish brown in the lower part. The underlying material is moderately alkaline, mottled grayish and brownish silty clay to a depth of 72 inches or more.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is high. In depressional areas water is ponded for a few hours following rains. The rooting zone is deep, but root penetration is restricted by the clay in the lower layers.

Urban land consists of areas that are covered by individual dwellings, small businesses, churches, apartments, and adjacent streets, driveways, parking lots, and patios. These structures obscure or alter the soil properties to the extent that classification of the soil is not feasible.

Included in mapping are small areas of Burleson, Culp, Ponder, and Sanger soils. The included soils make up less than 20 percent of the map unit.

This Wilson soil is poorly suited to most urban uses. Seasonal wetness, the shrinking and swelling of the soil with changes in moisture, corrosivity to uncoated steel, and the very slow permeability are the main limitations. Proper design and careful installation can overcome these limitations.

This soil is poorly suited to most recreation uses. The silty clay loam surface, seasonal wetness, and the very slow permeability are the main limitations.

This Wilson-Urban land complex is not assigned to capability subclass or to a range site.

Ya—Yahola-Gaddy complex, occasionally flooded. This complex consists of Yahola and Gaddy soils on bottom lands. These soils are deep, well drained, and nearly level to gently undulating. Flooding may occur about once every 3 to 5 years for brief periods. Slopes range from 0 to 2 percent. The long and narrow areas of the soils are along the Brazos River. Areas make up approximately 980 acres.

The Yahola soil makes up about 65 percent of the map unit, Gaddy soil about 20 percent, and other soils about 15 percent. These soils are so intricately mixed that mapping them separately was not practical.

The Yahola soil typically has a surface layer of reddish brown fine sandy loam about 17 inches thick. Below that to a depth of about 28 inches is brown fine sandy loam, to a depth of 38 inches is reddish yellow loam, and to a depth of 60 inches or more is yellowish red fine sandy loam.

The Gaddy soil typically has a surface layer of light yellowish brown loamy fine sand about 8 inches thick. Below that to a depth of 60 inches is very pale brown fine sand. Thin strata of finer material are below a depth of 19 inches.

These soils are well drained. Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium to low. These soils are subject to occasional flooding for very brief periods during May and September. The rooting zone is deep and is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Bastrop and Paluxy soils. Also included are some areas of gravel bars, stream channels, and a soil in depressional areas that is silty clay loam throughout. The included soils make up less than 20 percent of the map unit.

These soils are used mostly as rangeland, but a few acres are used for pasture.

These soils are moderately suited to use as pasture. Improved bermudagrass is well suited. Concerns in management are proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or mowing to control weeds.

These soils are moderately suited to use for crops. Suitable crops are small grains, forage sorghums, and wheat. Pecan trees are well suited to these soils. Crop residue returned to the soil helps conserve moisture and maintain tilth and productivity.

These soils are not suited to urban uses because of occasional flooding. The soils are moderately suited to recreation uses. Limitations are flooding and the sandy surface layers.

These soils are well suited to use as habitat for wildlife. Areas of the soils provide excellent cover and food for many songbirds, quail, doves, ducks, rabbits, squirrels, raccoons, and deer.

This Yahola-Gaddy complex, occasionally flooded, is in capability subclass IIw. The Yahola soil is in the Loamy Bottomland range site, and the Gaddy soil is in the Sandy Bottomland range site.

Prime Farmland

In this section, prime farmland is defined, requirements are discussed, and the prime farmland soils in Johnson County are listed.

Each year thousands of acres of land throughout the United States are converted from agricultural to industrial, urban, and other uses. Some of the land converted includes prime farmland soils.

Prime farmland is one of several goups of important farmland soils defined by the U.S. Department of Agriculture. They are of major importance in meeting the nation's short- and long-range needs for food and fiber. The supply of high quality farmland is limited, and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland soils.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season should be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may now be used for crops, pasture, as woodland, or other land uses. They must either be used for producing food or fiber or be available for these uses. Urban and built-up land is any contiguous unit of land 10 acres or more that is used for nonfarm uses, including residences, industrial sites, commercial sites, construction sites, institutional sites, railroad yards, small parks, cemeteries, airports, golf courses, sanitary landfills, sewage treatment plants, water control structures, and spillways. Urban and built-up land or water areas cannot be considered prime farmland.

Prime farmland soils usually have an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. Prime farmland soils are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. Slope ranges mainly from 0 to 5 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if these limitations are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of the corrective measures. For more detailed information on the criteria for prime farmland soils, consult the local staff of the Soil Conservation Service.

About 240,000 acres, or nearly 51 percent, of the soils in Johnson County meet the requirements for prime farmland soils. Areas are scattered throughout the county, but the largest areas of prime farmland soils are in general soil map units 1, 3, 4, and 5. Map units 2, 7, and 8 also have substantial areas of prime farmland. Map unit 6 has very few areas. Approximately 130,000 acres of these prime farmland soils are used for cultivated crops. The main crops are grain sorghum, cotton, wheat, oats, and forage sorghum; these crops provide a large part of the county's total agricultural income each year.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland soils to urban and industrial uses. The loss of prime farmland soils to other uses puts pressure on marginal lands, which are more erodible, droughty, difficult to cultivate, and less productive.

The following map units, or soils, make up the prime farmland in Johnson County.

BaB	Bastrop fine sandy loam, 0 to 3 percent slopes
BaC	Bastrop fine sandy loam, 3 to 5 percent slopes
BoB	Bolar clay loam, 1 to 3 percent slopes
BuA	Burleson clay, 0 to 1 percent slopes
BuB	Burleson clay, 1 to 3 percent slopes
CaB	Callisburg fine sandy loam, 1 to 3 percent slopes
CuB	Culp clay loam, 0 to 3 percent slopes
DeC	Decordova loamy fine sand, 0 to 5 percent slopes
DnB	Denton silty clay, 1 to 3 percent slopes
FhC	Ferris-Heiden complex, 2 to 5 percent slopes
Fr	Frio silty clay, occasionally flooded
GaB	Gasil loamy fine sand, 0 to 5 percent slopes
GfB	Gasil fine sandy loam, 1 to 3 percent slopes
GfC	Gasil fine sandy loam, 3 to 5 percent slopes
Gw	Gowen clay loam, occasionally flooded
HeB	Heiden clay, 1 to 3 percent slopes
HoA	Houston Black clay, 0 to 1 percent slopes

HoB	Houston Black clay, 1 to 3 percent slopes
KrB	Krum silty clay, 1 to 3 percent slopes
KrC	Krum silty clay, 3 to 5 percent slopes
LeB	Lewisville silty clay, 1 to 3 percent slopes
LeC	Lewisville silty clay, 3 to 5 percent slopes
LlB	Lindale clay loam, 1 to 3 percent slopes
LoB	Lott silty clay, 1 to 3 percent slopes
LuB	Luckenbach clay loam, 1 to 3 percent slopes
MnB	Minwells fine sandy loam, 1 to 3 percent slopes
PaB	Paluxy very fine sandy loam, 1 to 3 percent slopes
PnB	Ponder clay loam, 1 to 3 percent slopes
PnC	Ponder clay loam, 3 to 5 percent slopes
RaB	Rader fine sandy loam, 0 to 3 percent slopes
SaB	Sanger clay, 1 to 3 percent slopes
SaC	Sanger clay, 3 to 5 percent slopes
SlA	Slidell clay, 0 to 1 percent slopes
SlB	Slidell clay, 1 to 3 percent slopes
SuB	Sunev clay loam, 1 to 3 percent slopes
SuC	Sunev clay loam, 3 to 5 percent slopes
Ya	Yahola-Gaddy complex, occasionally flooded

This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 5. The location of each map unit is shown on the detailed soil maps in the back of this publication. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Robert M. Kral, conservation agronomist, and J.D. Ballard, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

In 1980, about 334,000 acres in the survey area was used for crops and pasture, according to records of the local office of the Soil Conservation Service. Of this total, about 155,000 acres was used for permanent pasture, 45,000 acres for row crops, mainly cotton and grain sorghum, and 134,000 acres for close-spaced crops, mainly wheat, oats, rye, and forage sorghum.

The soils in Johnson County are well suited to increased production of food. Of about 360,000 acres of arable land in the survey area, only about 179,000 acres was cultivated. In addition to the reserve production capacity of these soils, food production could also be increased considerably by extending the latest crop production technology to all cropland in the survey area. This soil survey can help facilitate the application of such technology.

Acreage in crops and pasture has been rapidly decreasing as more and more land is converted to urban uses. In 1967, about 17,000 acres was urban or built-up land in the survey area. This acreage is rapidly increasing. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General Soil Map Units."

Water erosion is the major concern on the cropland in Johnson County. If the slope is more than 1 percent, water erosion is a hazard. Bolar, Crosstell, Gasil, Heiden, and Krum soils, for example, have slopes of more than 1 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a sandy or loamy surface and a clayey subsoil, such as Crosstell, Minwells, Navo, and Ponder soils. Also, loss of the surface layer is damaging to soils that have a restricted rooting depth because of bedrock. Hensley and Purves soils are underlain by limestone at a shallow depth.

Second, water erosion results in sedimentation of streams, ponds, and reservoirs; wind erosion causes air pollution, and sediment covers roads, fences, and crops. Controlling erosion helps protect domestic water supplies, air quality, and fish and wildlife resources.

In many sloping fields, preparing a good seedbed is difficult on clayey spots because the original friable surface soil has been eroded away. Such spots are common in areas of eroded Crosstell and Minwells soils.

Effective *erosion control practices* increase the rate of water infiltration, reduce amount of runoff, and hold soil losses to amounts that can be tolerated without reducing productive capacity.

A cropping system that keeps a plant cover on the surface for extended periods helps protect the soil from erosion. Minimum tillage and crop residue returned to the soil help increase infiltration and reduce the hazard of erosion. These practices can be used on most soils in the survey area.

On livestock farms, which require pasture and hay, the forage crops of legumes and grasses in the cropping system reduce erosion, provide nitrogen, and improve soil tilth.

Contour farming, parallel terraces, and diversions are common erosion control practices used in the survey area. Terraces and diversions reduce the length of slope and help to slow runoff and control erosion. They are most practical on deep, moderately well drained and well drained soils that have regular slopes. Burlesion, Crosstell, Ferris, Gasil, Heiden, Houston Black, Navo, Ponder, Sanger, and Slidell soils are suitable for terraces. Other soils in the survey area are less suitable for terraces and diversions because of steep slopes, a thick sandy surface layer, bedrock at a depth of less than 20 inches, or flooding.

Soil blowing is a hazard on the sandy Coving, Decordova, Gasil, and Silstid soils. Strong winds can damage these soils in a few hours if they are dry and do not have a plant cover, dead-litter mulch, or surface mulch. Maintaining plant cover, surface mulch, or rough surfaces by proper tillage at timely intervals minimizes soil blowing. Crop residue and stripcropping provide protection for emerging seedlings.

Information on erosion control practices for each kind of soil can be obtained at the local office of the Soil Conservation Service.

Drainage is not a problem on most soils in Johnson County. Only Coving, Hassee, Tinn, and Wilson soils are somewhat poorly drained. Unless these soils are artificially drained, wetness in depressional areas may damage crops or pasture plants in some years. Burleson, Houston Black, and Slidell soils have good natural drainage most of the year, but they tend to dry out slowly after rainfall.

Soil fertility is naturally low in most of the light colored sandy or loamy soils on uplands. These soils are mainly slightly acid to neutral, and crops on them respond readily to fertilizer. Some soils that have a sandy or loamy surface layer need more than a single application of a complete fertilizer during the planting and growing season to keep fertility in balance and reduce loss of nutrients by leaching. Some of these light colored soils are Crosstell, Gasil, Rader, and Silstid soils. Fertility is naturally high in most soils on flood plains, such as Frio, Gowen, Pursley, and Tinn soils. The dark, more clayey, alkaline soils on uplands, such as Bolar, Denton, Heiden, Houston Black, Krum, Lewisville, Lott, and Sunev soils, are also high in natural fertility. In places these alkaline soils hold the nutrients in forms unavailable for plant use. On all soils, the amount and type of fertilizer to apply should be based on the results of soil tests, on the need of the crops, on the expected level of yields, on the previous land use or cropping sequence, and on the amount of available soil moisture. The Cooperative Extension Service can help in determining the kinds and amounts of fertilizer to apply.

Field crops suited to the soils and climate of the survey area include cotton, grain sorghum, wheat, oats, forage sorghum, peanuts, and rye. Other crops that are suited but not grown in a significant acreage are corn, guar, sunflowers, potatoes, barley, and castor beans.

Special crops grown commercially in the survey area are tomatoes, cabbage, peppers, black-eyed peas, watermelons, cantaloupe, okra, squash, and beans. Most other vegetables are adapted to the area. Peaches, pecans, blackberries, and pears are also grown.

The deep, loamy and sandy soils that have good natural drainage and that warm up early in the spring are especially well suited to many vegetables and small fruits. In the survey area, the nearly level to gently sloping Bastrop, Callisburg, Crosstell, Decordova, Gasil, Minwells, Paluxy, Rader, and Silstid soils are well suited. Crops can generally be planted and harvested earlier on these soils than on other soils in the survey area.

Most of the well drained, loamy and sandy soils in the survey area are suitable for orchards and nursery plants. Low-lying soils, where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables and orchards of small fruit species.

Latest information and suggestions for growing special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Improved pasture grasses suited to the area include several varieties of bermudagrass, several varieties of lovegrass, kleingrass, and tall fescue. Legumes, such as vetch, singletary peas, sweet clover, and arrowleaf clover, can be grown in pure stands but usually are interseeded in sod-forming grasses, such as bermudagrass. Major management practices for pasture include fertilizing, controlling weeds, and controlling grazing. The amount and type of fertilizer to apply should be based on plant needs, on the level of production desired, and on the results of soil tests. Weeds are less likely to be a problem on properly grazed, well-managed pasture; on overgrazed, poorly managed pastures desirable pasture plant population is reduced.

Hay is commonly harvested from bermudagrass and often from other improved grasses. Some producers earn income by selling seed from kleingrass or lovegrass or by selling sprigs of bermudagrass.

Temporary pasture is used in many places to supplement permanent pasture or to produce hay. Sudangrass, sorghum-sudangrass crosses, and johnsongrass make good supplemental summer pasture. Small grains provide good supplemental winter forage.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, animal manure, and green-manure crops; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have slight limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

Robert M. Kral, conservation agronomist, Soil Conservation Service, helped prepare this section.

Rangeland is land on which the native vegetation consists mainly of grasses and some grasslike plants, forbs, shrubs, and trees. The vegetative species are generally suitable for grazing, and growth is sufficient to be used for grazing. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community is determined by soil, climate, topography, overstory canopy, and grazing management.

In 1980 about 120,000 acres, or 25 percent, of Johnson County was rangeland, according to records of the local office of the Soil Conservation Service. Beef and dairy cattle and a few small herds of sheep and goats graze this rangeland. Many horses are also raised in the county, but few are used for ranch work. Most horses are used for recreation. Most of the ranches in the survey area are cow-calf operations, and many supplement their operation with winter stockers. This practice provides greater flexibility for adjusting the number of livestock to be cared for in periods of drought. Most ranches include some acreage for crops or improved pasture. This supplemental forage is either grazed or harvested for hay. The main forage crops are small grains and forage sorghum. In areas where peanuts are grown, the vines are baled for hay after the peanuts are harvested. Improved pastures consist mainly of improved bermudagrass, kleingrass, and weeping lovegrass.

The native rangeland in the county has been heavily grazed for several generations. Originally, the western third of the county produced a wide variety of tall and mid grasses interspersed among an abundance of forbs. Now, much of the rangeland is covered by short and mid grasses, poor quality forbs, juniper, mesquite, and sumac. The middle one-third of the county was a savannah characterized by tall grasses, forbs, post oak, and blackjack oak, but now has mostly mid grasses, poor quality forbs, post oak, blackjack oak, mesquite, and scattered juniper.

Remnants of the original plant species still are found in protected areas on most grasslands, and in most cases, good grazing management will allow these high quality plants to reestablish themselves.

Approximately 75 percent of the annual growth of forage production takes place in March, April, May, and June when spring rains and moderate temperatures are favorable for the growth of warm-season plants. A secondary growth period is in September and October when fall rains and gradually cooling temperatures are common.

Droughts of varying length are common in this area. Each year short midsummer droughts normally occur. Less frequently, longer periods of drought last for several months.

The major concern in management of most rangeland is to control grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. This can be done by proper stocking and a deferred grazing system. Controlling brush is also important. This can be done mechanically, chemically, or biologically. Seeding adapted grasses, such as little bluestem, indiangrass, sideoats grama, and King Ranch bluestem, in areas of inadequate vegetation prevents excessive runoff and erosion and furnishes desirable forage. If sound range management based on soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of rangeland in the area.

Range Sites and Condition Classes

Different kinds of soil vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds, amounts, and proportions of forage make up a range site.

Climax vegetation on the range site is the stabilized plant community that the site is capable of producing. It consists of plants that were growing there when the region was first settled. This plant community reproduces itself and remains about the same as long as the environment does not change. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that decrease in yield and number under continuous heavy use. They generally are the tallest and most productive perennial grasses and forbs and are the most palatable to livestock.

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. However, invaders grow along with increasers after the climax vegetation has been reduced by continuous heavy use. Some invaders have little value for grazing.

Range condition is judged according to the standards that apply to the particular range site. It is the present kind and amount of vegetation in relation to the climax plant community for that site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation. The classes show the present condition of the native vegetation on a range site as compared to th native vegetation that could grow there. A range site is i excellent condition if 76 to 100 percent of the vegetatio is of the same kind as that in the climax stand; in good condition if the percentage is 51 to 75; in fair condition i the percentage is 26 to 50; and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during the growing season.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for each soil, the range site and the total annual production of vegetation in favorable, normal, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In Johnson County 17 different range sites have been identified. They are the Blackland, Clay Loam, Clay Loam Slopes, Clayey Bottomland, Claypan Prairie, Deep Redland, Eroded Blackland, Loamy Bottomland, Loamy Sand, Redland, Sandstone Hill, Sandy, Sandy Bottomland, Sandy Loam, Shallow, Steep Adobe, and Tight Sandy Loam range sites.

Blackland range site. The main soils in this range site are the Burleson soils (BuA, BuB,), Heiden soils (FhC, HeB, HeD), Houston Black soils (HoA, HoB), Sanger soils (SaB, SaC), and Slidell soils (SlA, SlB). The climax plant community is a tall grass prairie. The composition by weight is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Typically, little bluestem, indiangrass, and big bluestem make up about 70 percent of the climax vegetation. Other grasses are eastern gamagrass, switchgrass, Virginia wildrye, Florida paspalum, sideoats grama, silver bluestem, Texas wintergrass, Texas cupgrass, vine-mesquite, meadow dropseed, white tridens, and plains lovegrass. Forbs include Maximilian sunflower, Engelmann-daisy, blacksamson, penstemon, dotted gayfeather, sundrops, bundleflower, sensitivebrier, yellow neptunia, prairie-clover, snoutbean, wildbeans, tickclover, scurfpea, western indigo, prairie senna, paintbrush, and gaura. Woody plants mainly in scattered mottes include live oak, elm, hackberry, bumelia, and coralberry.

When the tall grasses are grazed out through continuous heavy use, they are replaced by silver bluestem, Texas wintergrass, sideoats grama, and meadow dropseed. If heavy use continues, these plants also are grazed out and are replaced by mesquite, winged elm, honeylocust, osageorange, Texas grama, tumblegrass, and annual grasses and forbs.

Clay Loam range site. The main soils in this range site are the Altoga soil (AtB), Bolar soils (AbC, BoB, BoC), Culp soil (CuB), Denton soil (DnB), Krum soils (KrB, KrC), Lewisville soils (LeB, LeC), Lott soil (LoB), Luckenbach soil (LuB), Seawillow soils (SeC, SeE), and Sunev soils (SuB, SuC). The climax plant community of this true prairie is mainly tall grasses. The composition by weight is about 90 percent grass, 5 percent forbs, and 5 percent woody vegetation.

Typically, little bluestem, switchgrass, big bluestem, and indiangrass make up about 70 percent of the vegetation. Other grasses are wildrye, sideoats grama, Texas wintergrass, vine-mesquite, Texas cupgrass, white tridens, meadow and tall dropseed, and silver bluestem. Forbs include Engelmann-daisy, Maximilian sunflower, yellow neptunia, catclaw sensitivebrier, prairie-clover, scurfpea, gaura, heath aster, blue salvia, trailing ratany, blacksamson, golden dalea, bigtop dalea, wildbean, tickclover, dotted gayfeather, and bundleflower. Woody plants include elm, hackberry, pecan, plum, and live oak.

When this range site is continuously in heavy use and range conditions begin to deteriorate, big bluestem is the first grass to be grazed out, followed by indiangrass, switchgrass, and little bluestem. They are replaced by sideoats grama, Texas wintergrass, and tall and meadow dropseed. If heavy use continues, the plants in the range site will consist mainly of buffalograss, Texas grama, tumblegrass, red threeawn, western ragweed, Baldwin ironweed, queensdelight, mesquite, sumac, and common honeylocust.

Clay Loam Slopes range site. The main soil in this range site is Bolar soil (BpE). The climax plant community is a juniper savannah. The composition by weight is about 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

Typically, little bluestem, big bluestem, indiangrass, and sideoats grama make up about 60 percent of the vegetation. Other grasses are wildrye, Texas wintergrass, meadow dropseed, white tridens, silver bluestem, hairygrama, and threeawn. Forbs include Engelmann-daisy, yellow neptunia, gayfeather, heath aster, trailing ratany, and prairie-clover. Woody plants include Ashe juniper, Texas ash, live oak, Texas oak, sumac, cedar elm, and redbud.

When this range site is continuously in heavy use, big bluestem is first grazed out, followed by indiangrass and little bluestem. The woody overstory increases rapidly. Sideoats grama, Texas wintergrass, Virginia wildrye, and Canada wildrye increase initially but decrease as regression continues. If heavy use continues, the composition will become about 80 percent or more woody canopy, dominated by sumac and then by Ashe juniper. Because of the dense shade, climax grasses are not suited and Texas sage, western ragweed, and annuals invade the range site.

Clayey Bottomland range site. The main soil in this range site is the Tinn soil (Tn). The climax vegetation is tall grasses that have a woody overstory. The composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Typically, near the stream channel where the areas are brushy, sedges, Virginia and Canada wildrye, and rustyseed paspalum make up about 35 percent of the composition, and beaked panicum, switchgrass, indiangrass, big bluestem, longleaf uniola, and knotroot bristlegrass make up about 30 percent. Away from the stream channel where the woody canopy cover is less dense (less than 30 percent), the grasses are eastern gamagrass, Florida paspalum, little bluestem, redtop panicum, vine-mesquite, big bluestem, indiangrass, and switchgrass. Woody plants include oak, elm, cottonwood, pecan, hackberry, black willow, grape, hawthorn, and woody vines. Forbs include tickclover, wildbean, snoutbean, lespedeza, Maximilian sunflower, Pitcher sage, blood ragweed, ironweed, white crownbeard, and dotted gayfeather.

When this range site is continuously in heavy use and range conditions begin to deteriorate, trees and shrubs form a dense canopy. Shade-tolerant and winter-growing grasses increase. If heavy use continues, plants that invade are broomsedge bluestem, bushy bluestem, prairie coneflower, baccharis, locust, osageorange, smutgrass, carpetgrass, low panicum, and paspalum.

Claypan Prairie range site. The main soils in this range site are the Hassee soil (HaA), Navo soils (NaC, NwB), Ponder soils (PnB, PnC), and Wilson soils (WsA, WsB). The climax plant community is a prairie mainly of tall grasses. The composition by weight is about 90 percent grass, 5 percent forbs, and 5 percent woody vegetation.

Typically, little bluestem, switchgrass, big bluestem, and indiangrass make up about 70 percent of the vegetation. Other grasses are wildrye, sideoats grama, Texas wintergrass, vine-mesquite, Texas cupgrass, white tridens, meadow and tall dropseed, and silver bluestem. Forbs include Engelmann-daisy, Maximilian sunflower, yellow neptunia, catclaw sensitivebrier, prairie-clover, scurfpea, gaura, heath aster, blue salvia, trailing ratany, blacksamson, golden dalea, bigtop dalea, wildbean, tickclover, dotted gayfeather, and bundleflower. Woody plants include elm, hackberry, pecan, plum, and live oak.

When this range site is continuously in heavy use, big bluestem is first grazed out, followed by indiangrass, switchgrass, and little bluestem. Sideoats grama, Texas wintergrass, and tall and meadow dropseed increase initially but decrease as regression continues. If heavy use continues, the composition will become mainly buffalograss, Texas grama, tumblegrass, red threeawn, western ragweed, Baldwin ironweed, queensdelight, mesquite, sumac, and common honeylocust.

Deep Redland range site. Lindale soil (LlB) is the main soil in this range site. The climax vegetation is mid and tall grasses. The composition by weight is 90 percent grass, 5 percent woody plants, and 5 percent forbs.

Typically, indiangrass, big bluestem, and little bluestem make up 35 percent of the vegetation, and sideoats grama and Texas wintergrass make up about 20 percent. Other grasses are Texas cupgrass, cane bluestem, silver bluestem, buffalograss, Canada wildrye, vine-mesquite, Wright threeawn, tall dropseed, white tridens, meadow dropseed, and plains lovegrass. Woody plants include live oak, greenbrier, hackberry, sumac, Texas oak, and bush honeysuckle. Forbs include Maximilian sunflower, bushsunflower, Engelmann-daisy, dotted gayfeather, blacksamson, Mexican sagewort, Pitcher sage, halfshrub sundrop, bundleflower, prairie-clover, trailing wildbean, least snoutbean, tickclover, scurfpea, western indigo, knotweed, leafflower, heath aster, ruellia, gaura, and mallow.

When the tall grasses are grazed out through continuous heavy use, they are replaced by sideoats grama, Texas wintergrass, silver bluestem, and buffalograss. If heavy use continues, the site becomes dominated by buffalograss and Texas wintergrass. On a range site that is in poor condition are woody species, such as mesquite, persimmon, juniper, and lotebush, and forbs, such as horehound, eryngo, prairie coneflower, and western ragweed.

Eroded Blackland range site. The main soils in this range site are the Ferris soils (FeD2, FhC) and Medlin soil (MeD). The climax plant community is a mid and tall grass prairie. The vegetation is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Typically, little bluestem makes up about 40 percent by weight of all plants, and indiangrass and big bluestem make up 25 percent. Other grasses are vine-mesquite, silver bluestem, sideoats grama, tall dropseed, Texas wintergrass, slim and rough tridens, buffalograss, Virginia and Canada wildrye, sedges, purple threeawn, Florida paspalum, and plains lovegrass. Forbs include Maximilian sunflower, Engelmann-daisy, halfshrub sundrop, penstemon, dotted gayfeather, blacksamson, prairie-clover, bundleflower, sensitivebrier, yellow neptunia, snoutbean, wildbean, scurfpea, western indigo, gaura, paintbrush, verbena, scullcap, larkspur, winecup, woolywhite, and prairie parsley. Woody plants include oak, hackberry, elm, bumelia, hawthorn, coralberry, and elbowbush.

When little bluestem and the tall grasses are grazed out through continuous heavy use of the range site, silver bluestem, sideoats grama, tall dropseed, and Texas wintergrass take their place. If heavy use continues, these species decrease and are replaced by buffalograss. Then if heavy use continues, this grass is replaced by a cover largely of Texas grama, hairy tridens, windmillgrass, tumblegrass, queensdelight, mesquite, and many annual grasses and forbs.

Loamy Bottomland range site. The main soils in this range site are the Frio soil (Fr), Gowen soils (Gw, Gy), Pulexas soil (Pp), Pursley soil (Pr), and Yahola soil (Ya). The climax plant community is mid and tall grasses and a tree canopy of pecan, elm, hackberry, post oak, blackjack oak, live oak, cottonwood, and western soapberry. The canopy shades about 25 percent of the ground. The vegetation is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Typically, little bluestem, big bluestem, indiangrass, switchgrass, purpletop tridens, and wildrye are the main grasses. Other grasses are tall and meadow dropseed, vine-mesquite, sand lovegrass, Texas bluegrass, and beaked panicum. Woody plants include pecan, American elm, live oak, post oak, hackberry, cedar, elm, greenbrier, sumac, red ash, redbud, red mulberry, downy viburnum, western soapberry, coralberry, and grape. Forbs include Engelmann-daisy, Maximilian sunflower, trailing wildbean, lespedeza, gaura, dotted gayfeather, dalea, penstemon, and tickclover.

When the tall grasses are grazed out through continous heavy use, mid grasses increase. However, these grasses can also be grazed out if heavy use continues. Woody plants will dominate the range site if it is in poor condition, and mesquite, persimmon, milkweed, tumblegrass, Texas grama, and common bermudagrass will invade the site.

Loamy Sand range site. The main soils in this range site are the Decordova soil (DeC) and Gasil soil (GaB). The climax vegetation is a mid and tall grass savannah that has scattered post oak and blackjack oak. The vegetation is 80 percent grasses, about 15 percent woody and brushy plants, and 5 percent forbs.

Typically, little bluestem, big bluestem, and indiangrass make up about 40 percent of all plants. Other grasses are sand lovegrass, Texas bluegrass, purpletop tridens, cane and silver bluestem, sand and tall dropseed, sideoats grama, Canada wildrye, switchgrass, plains lovegrass, and Scribner panicum. Woody plants include post oak and blackjack oak. Brushy plants are bumelia, greenbrier, sumac, pricklyash, hackberry, and shinnery oak. Forbs include Engelmann-daisy, Maximilian sunflower, Mexican sagewort, dotted gayfeather, dalea, yellow neptunia, sensitivebrier, trailing wildbean, primrose, prairie senna, gaura, and buckwheat.

When this range site is continuously in heavy use, big bluestem, indiangrass, switchgrass, and palatable forbs are grazed out, and range conditions begin to deteriorate. Silver bluestem, tall and sand dropseed, and woody plants increase. If heavy use continues, fall witchgrass, hooded windmillgrass, red, tumble, and gummy lovegrass, tumblegrass, and threeawn invade the range site. Blackjack oak, post oak, greenbrier, and shinnery oak dominate the range site in poor condition.

Redland range site. The main soil in this range site is the Hensley soil (HnB). The climax plant community is mid and tall grasses and scattered mottes of live oak, elm, hackberry, and shinnery oak. The composition is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

Typically, indiangrass, big bluestem, little bluestem, and sideoats grama make up 65 percent by weight of the composition of all plants; and switchgrass, Canada wildrye, Texas wintergrass, hairy grama, silver bluestem, tall dropseed, vine-mesquite, white tridens, and buffalograss make up about 20 percent. Woody plants include live oak, elm, hackberry, greenbrier, elbowbush, bumelia, shinnery oak, and post oak. Forbs include Engelmann-daisy, yellow neptunia, catclaw sensitivebrier, wildbean, dalea, prairie-clover, dotted gayfeather, gaura, ruellia, blacksamson, bushsunflower, and Mexican sagewort.

When this range site is continuously in heavy use, the tall grasses are grazed out, and range conditions begin to deteriorate. Texas wintergrass, tall dropseed, silver bluestem, and buffalograss increase. If heavy use continues, the tall grasses are replaced with Texas grama, sand dropseed, tumblegrass, tumble windmillgrass, threeawn, curlycup gumweed, pricklypear cactus, and mesquite.

Sandstone Hill range site. The main soils in this site are the Birome and Rayex soils (BmE). The climax plant community is a savannah of mid and tall grasses. There is an abundance of low growing woody vines and shrubs. The vegetation is about 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Typically, little bluestem makes up about 35 percent of the vegetation, and purpletop tridens, indiangrass, and beaked panicum make up about 30 percent. Other grasses are big bluestem, sand lovegrass, sideoats grama, tall dropseed, Texas wintergrass, vine-mesquite, silver bluestem, plains lovegrass, purple threeawn, hairy grama, Scribner panicum, and sedges. Woody plants are post oak and blackjack oak, greenbrier, dewberry, coralberry, bumelia, and sumac. Forbs include lespedeza, wildbean, yellow neptunia, tickclover, snoutbean, and catclaw sensitivebrier.

When this range site is continuously in heavy use and range conditions begin to deteriorate, little bluestem is first grazed out and the woody overstory increases. This creates a shaded habitat that is not suitable for the more palatable grasses. If heavy use continues, an overstory largely of oak and sumac will dominate and an understory of western ragweed, curlycup gumweed, broomsedge bluestem, splitbeard bluestem, tumblegrass, Texas grama, red threeawn, sand dropseed, and buffalograss will invade the area.

Sandy range site. The main soils in this site are the Coving soil (CoB) and Silstid soils (SfB, SfD). The climax plant community is a post oak-blackjack oak savannah that has tall and mid grasses. The oak overstory shades about 20 percent of the ground. Vegetative composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Typically, little bluestem, big bluestem, indiangrass, switchgrass, beaked panicum, purpletop tridens, sand lovegrass, Florida paspalum, and Virginia and Canada wildrye make up 70 percent of the grasses. Other grasses are tall dropseed, silver bluestem, Scribner panicum, fringeleaf paspalum, purple lovegrass, Carolina jointtail, sideoats grama, meadow dropseed, and sedges. Woody plants include post oak, blackjack oak, elm, greenbrier, plum, grape, hawthorn, American beautyberry, elbowbush, coralberry, Carolina snailseed, and berryvine. Forbs include Maximilian sunflower, Engelmann-daisy, tickclover, lespedeza, snoutbean, wildbean, catclaw sensitivebrier, yellow neptunia, blacksamson, gaura, and western indigo.

When this range site is continuously in heavy use, big bluestem and sand lovegrass are first grazed out, followed by indiangrass, little bluestem, Virginia and Canada wildrye, beaked panicum, and Florida paspalum. If heavy use continues, tall dropseed, sideoats grama, and silver bluestem increase initially, but these plants also decrease if heavy grazing is prolonged. Further heavy use results in an increase in the canopy cover of oak and in low growing shrubs and vines. Persimmon, sumac, winged elm, tumble windmillgrass, narrowleaf rushfoil, and western ragweed are invaders.

Sandy Bottomland range site. The only soil in this site is the Gaddy soil (Ya). The climax plant community is a tall grass savannah. The composition by weight is about 80 percent grasses, 15 percent woody plants, and 5 percent forbs.

Typically, switchgrass, indiangrass, and little bluestem make up about 45 percent of the vegetation. Other grasses are eastern gamagrass, big bluestem, purpletop tridens, Canada wildrye, and sideoats grama. Forbs include Maximilian sunflower, clammyweed, western ragweed, western indigo, and trailing wildbean. Woody vegetation includes cottonwood, elm, willow, greenbrier, and pecan.

When the range site is continuously in heavy use and the range condition begins to deteriorate, eastern gamagrass, big bluestem, indiangrass, and little bluestem are grazed out. If heavy use continues, the tall grasses will be replaced with sand dropseed, hooded windmillgrass, silver bluestem, western ragweed, bullnettle, greenbrier, oak, and chinaberry.

Sandy Loam range site. The main soils in this range site are the Bastrop soils (BaB, BaC), Callisburg soil (CaB), Gasil soils (GfB, GfC, GfD4), Minwells soils (MuB, MnC2), Paluxy soil (PaB), and Rader soil (RaB). The climax plant community is a post oak-blackjack oak savannah of tall and mid grasses. The oak overstory shades about 20 percent of the ground. Vegetative composition is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Typically, little bluestem, big bluestem, indiangrass, switchgrass, beaked panicum, purpletop tridens, sand lovegrass, Florida paspalum, and Virginia and Canada wildrye make up 70 percent of the grasses. The rest is tall dropseed, silver bluestem, Scribner panicum, fringeleaf paspalum, purple lovegrass, Carolina jointtail, sideoats grama, meadow dropseed, and sedges. Woody plants include post oak, blackjack oak, elm, greenbrier, plum, grape, hawthorn, American beautyberry, elbowbush, coralberry, Carolina snailseed, and berryvine. Forbs include Maximilian sunflower, Engelmann-daisy, tickclover, lespedeza, snoutbean, wildbean, catclaw sensitivebrier, yellow neptunia, blacksamson, gaura, and western indigo.

When this range site is continously in heavy use and the range condition begins to deteriorate, big bluestem and sand lovegrass are first grazed out, followed by indiangrass, little bluestem, Canada and Virginia wildrye, beaked panicum, and Florida paspalum. If heavy uses continues, tall dropseed, sideoats grama, and silver bluestem increase initially but decrease with prolonged heavy use. The canopy cover of oak and low-growing shrubs and vines invade the area. When the range is in poor condition, common persimmon, sumac, winged elm, tumble windmillgrass, narrow-leaf rushfoil, and western ragweed are present.

Shallow range site. The main soils in this range site are mainly the Aledo soils (AbC, BpE) and Purves soils (PuB, PuC). The climax plant community is mid and tall grasses interspersed with an abundance of forbs. The composition by weight is about 95 percent grasses and 5 percent forbs.

Typically, little bluestem makes up about 45 percent of the composition, and indiangrass, big bluestem, and switchgrass make up 15 percent. Other grasses are mostly sideoats grama, tall dropseed, slim tridens, silver bluestem, Texas cupgrass, hairy grama, buffalograss, Texas wintergrass, and vine-mesquite. Forbs include Engelmann-daisy, scurfpea, prairie-clover, Maximilian sunflower, catclaw sensitivebrier, heath aster, golden dalea, penstemon, gaura, false gaura, snoutbean, and dotted gayfeather.

When this range site is continuously in heavy use and range condition begins to deteriorate, big bluestem is replaced by indiangrass and switchgrass. If heavy use continues, little bluestem, sideoats grama, and tall dropseed increase initially but decrease with prolonged heavy use. When the range is in poor condition, mesquite, pricklypear, yucca, Texas grama, hairy tridens, tumblegrass, red threeawn, Hall panicum, curlycup gumweed, queensdelight, milkweed, nightshade, and western ragweed invade the site.

Steep Adobe range site. The main soil in this site is the Brackett soil (BrE). The climax vegetation is mainly tall grasses and scattered clumps of oak. The vegetation is about 80 percent grasses, about 15 percent woody plants, and 5 percent forbs.

Typically, about 40 percent of the grasses is little bluestem, indiangrass, and big bluestem; 25 percent is sideoats grama, tall grama, and hairy grama; and 15 percent is hairy dropseed, silver bluestem, and rough tridens. Woody plants include Texas oak, live oak, juniper, and sumac. Forbs include wild alfalfa, big dalea, white milkwort, trailing ratany, dotted gayfeather, and prairie-clover.

When this range site is continuously in heavy use and the range condition begins to deteriorate, little bluestem, big bluestem, and indiangrass and the more palatable grasses are initially grazed out. Sideoats grama, hairy dropseed, silver bluestem, and hairy grama increase. If heavy use continues, Texas grama, perennial threeawn, hairy tridens, red grama, and queensdelight invade the site. If the range site is in poor condition, the vegetation is dominantly an overstory of juniper and Texas oak.

Tight Sandy Loam range site. The main soils in this range site are the Crosstell soils (CrB, CrD). The climax plant community is a post oak-blackjack oak savannah. The vegetation is about 70 percent grasses, 20 percent woody plants, and 10 percent forbs.

Typically, sideoats grama makes up about 30 percent of the vegetation; little bluestem, silver bluestem, Texas wintergrass, and buffalograss make up 30 percent; and other grasses, such as big bluestem, indiangrass, Canada wildrye, hairy grama, Wright threeawn, and Scribner panicum make up the rest. Woody plants include post oak, blackjack oak, bumelia, greenbrier, coralberry, hackberry, plum, skunkbush sumac, and elm. Forbs are mainly yellow neptunia, lespedeza, catclaw sensitivebrier, Mexican sagewort, tickclover, and wildbean.

When this range site is continuously in heavy use and range conditions begins to deteriorate, a woody overstory forms a dense canopy and woody underbrush increases. If heavy use continues, tumble lovegrass, tumble windmillgrass, Texas grama, oldfield threeawn, gummy lovegrass, curlycup gumweed, tasajillo, and mesquite invade the area. If the oak trees are removed, little reestablishment of oak can be expected through natural succession, even with proper range use. Mesquite will dominate the plant community.

Recreation

Edward M. Schwille, biologist, Soil Conservation Service, helped prepare this section.

About 25 to 30 percent of the survey area is used for commercial and noncommercial recreation purposes. Fishing areas, vacation cabins, cottages, homesites, camping, picnicking, and other water-related activities are adjacent to Lake Whitney, Lake Pat Cleburne, Cedar Lake, Lake Alvarado, and the Brazos and Nolan Rivers. These water areas range from 1/4 acre to 40 acres.

Some public hunting areas and recreation facilities are adjacent to Ham Creek on the U.S. Corps of Engineers property at the upper end of Lake Whitney. Cleburne State Park provides excellent recreational facilities—several picnic sites, a camping area, a minibike trail, nature trails, and canoeing.

Seasonal leases from some landowners in the county are available for dove and quail hunting.

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, nature trails, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Gardening and Landscaping

Homeowners who want to landscape their homes need to know what kind of soil is on the homesite and the kinds of ground cover, vines, shrubs, and trees to which this soil is best suited. In some areas, plants may be needed for erosion control as well as for esthetic purposes.

Soils that are well suited to yard and garden plants have a deep root zone, a loamy texture, a balanced supply of plant nutrients, a large amount of organic matter in various stages of decomposition, an adequate available water capacity, good drainage, and a granular structure that allows free movemment of water, air, and roots. The degree of acidity or alkalinity suitable for the particular plant to be grown is also important. For example, roses and most annual flowers, vegetables, and grasses generally grow best in soils that are noncalcareous and are neutral or only slightly acid in reaction. Azaleas, camellias, and similar plants need acid soils. Some plants grown on soils that have a high content of lime, such as Houston Black or Sanger soils, develop chlorosis, or yellowing of the leaves. However, many flowers, shrubs, and trees that are grown in Johnson County are well suited to calcareous, limy soils. Canna, hollyhocks, petunia, zinnia, and gladioli are such lime-tolerant flowers; and crapemyrtle, nandina, duranta, crabapple, live oak, and pecan are lime-tolerant shrubs and trees.

Some of the flowers, ground cover, vines, shrubs, and trees suitable for the soils in the survey area are listed in table 10. Some of these plants are native to Johnson County. Local nurserymen or the County Extension Horticulturist can supply the names of other plants suited to the soils in Johnson County.

The first column in table 8 lists the soils and map symbols. The more common flowers and ground cover plants adapted to each soil are listed. The vines, shrubs, and trees in the table are those most commonly grown. Soil texture, drainage, permeability, structure, and other characteristics are given in the map unit descriptions in the section "Detailed Soil Map Units" and the series descriptions in "Soil Series and Their Morphology." Soil reaction (pH), permeability, and available water capacity are given in table 15.

Conditioning the native soil is generally preferable and more economical than replacing it with manmade soil material. The soil should be tested, and the fertility needs determined for the plants to be grown. Organic matter is the most important amendment to the soil. This material may be peat moss, compost, rotted sawdust, or manure. Organic waste from the kitchen, leaves, grass clippings, and sawdust are excellent sources of material for compost piles. Generally, at least 2 inches of organic matter should be added to the soil. For clayey soils, at least 2 inches of fertile loam or sand, perlite, calcined clay, or vermiculite should be added, and 5 pounds of superphosphate (0-20-0) or 16-20-0 fertilizer and 10 pounds of gypsum per 100 square feet broadcast over the surface. This material should be spaded or rototilled into the top 8 inches of the native soil. If an acid soil is needed, 1 to 2 pounds of sulfur should be incorporated. Soil that is too strongly acid can be neutralized by adding bonemeal, lime, wood ashes, or topsoil from calcareous soil, such as Sunev or Frio soil.

In some areas of the county the soils are so clayey, shallow, or poorly drained that raised beds need to be constructed to grow flowers and some kinds of shrubs. Brick, tile, metal, cedar, or redwood makes a good retainer along the edge of the bed. Beds should be filled with soil material that has well balanced physical and chemical amendments.

All plants, whether grown in native soil or in manmade soils, require careful maintenance, especially during the period of establishment. Good management practices include fertilizing, watering, and controlling weeds and insects.

Gardening and landscaping should be included in the basic planning of urban uses for the soil. It is also important to protect existing trees during the period of construction. In wooded areas, large healthy trees are a valuable asset to the property. Many trees are killed or damaged beyond restoration because of carelessness in excavating, filling, and constructing. The Soil Conservation Service or Cooperative Extension Service can supply guidelines for the protection of existing trees.

Wildlife Habitat

Edward M. Schwille, biologist, Soil Conservation Service, and Jim Dillard, wildlife biologist, Texas Parks and Wildlife Department, helped prepare this section.

Doves, bobwhite quail, and waterfowl are common wildlife throughout Johnson County. Bottom lands along the Brazos and Nolan Rivers and along the Mustang, Turkey, Chambers, and Mountain Creeks and their tributaries are good habitat for fox squirrels and other furbearers.

Johnson County is not considered a primary habitat for mourning doves, yet these birds receive heavy hunting pressure in harvested small grain and grain sorghum fields. The East Cross Timbers and Grand Prairie Land Resource Areas support large numbers of bobwhite quail when managed properly. The Blackland Prairie Land Resource Area has fewer quail because it is used mainly for crops and cover is sparse.

White-tailed deer and turkey inhabit primarily the southwestern part of the county. The deer population is light (1 deer per 66 acres). Urban development, reduction of woody cover, and increased acreage of improved pasture have reduced the acreage available as habitat for deer and turkey.

Mallard, pintail, teal, and gadwall ducks use the ponds and lakes during migratory periods. Wood ducks are resident in locations where the habitat is suitable. Geese and sandhill cranes are transient.

Raccoons, opossums, red and gray foxes, and skunks are furbearers and are a significant wildlife resource in Johnson County. Coyotes and bobcats are also hunted. The beaver population has expanded on small lakes and some streams.

Endangered and threatened species are important. Bald eagles have been sighted over Lake Whitney. The Arctic peregrine falcon and the whooping crane migrate through this area. Golden-cheeked warblers possibly can be found in southwestern Johnson County; they are known to inhabit stands of mature Ashe juniper in Bosque County, which borders the southwestern corner of the county.

Lake Whitney, Lake Pat Cleburne, Cedar Lake, Lake Alvarado, and small lakes and ponds provide good fishing for warm-water species, such as black bass, crappie, sunfish, channel catfish, and flathead channel. Striped bass and their selected hybrids have been stocked in Lake Whitney.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or

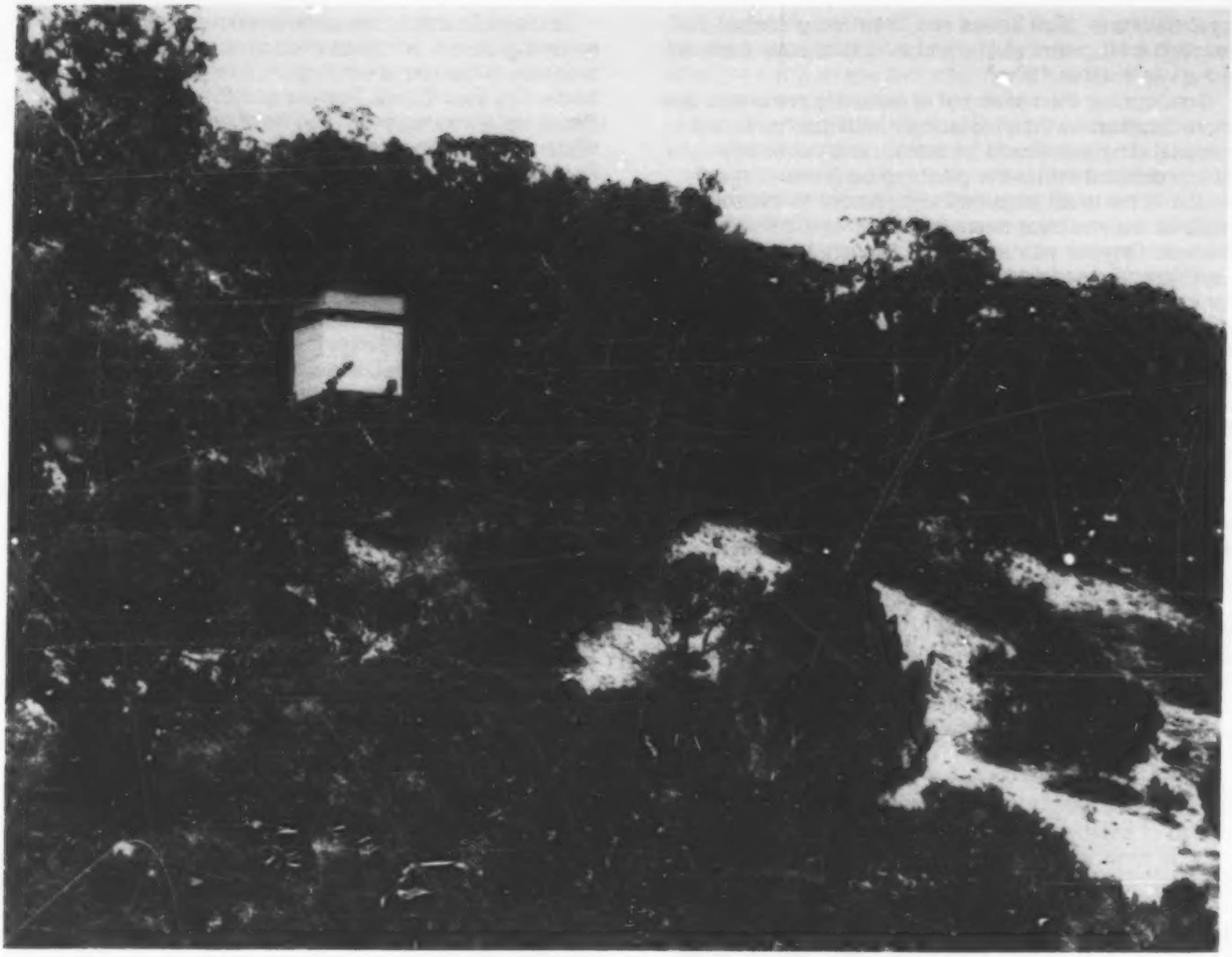


Figure 13.—Juniper-covered hill of Brackett-Rock outcrop complex, steep, provides cover for deer.

maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are grain sorghum, wheat, oats, rye, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, kleingrass, arrowleaf clover, and vetch.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestems, switchgrass, Maximilian and common sunflower, western ragweed, partridgepea, lespedeza, and giant cane.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are flameleaf and skunkbush sumac, plum, elbowbush, and condalia.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, buttonbush, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, doves, mockingbirds, songbirds, cottontails, and armadillos.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are shore birds, redwing blackbirds, beaver, and teal, mallard, and wood ducks.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants (fig. 13). Wildlife attracted to rangeland include deer, coyote, bobwhite quail, turkey, cardinal, and bluebirds.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 10 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 11 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 11 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 11 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage caused by rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 11 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 12, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 13 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment.

Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; and subsidence of organic layers. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 17.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 14 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GC, SP, SM, and SC; silty and clayey soils as ML, CL, and CH. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 17.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 15, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Engineering Index Test Data

Table 17 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle index)—T 100 (AASHTO), D 653 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*4*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustalf (*Ust*, meaning burnt, plus *Alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustalfs. (*Hapl*, meaning minimal horizonation, plus *ustalf*, the suborder of the Alfisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, thermic Typic Haplustalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Lindale series, which is a member of the fine, mixed, thermic family of Typic Haplustalfs.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*3*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*4*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Aledo Series

The Aledo series consists of shallow, well drained, loamy soils on uplands. These soils formed in interbedded limestone and marl. Slope ranges from 2 to 8 percent.

Typical pedon of Aledo clay loam in an area of Aledo-Bolar complex, 2 to 8 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 10.2 miles west on U.S. Highway 67, and 100 feet south in rangeland:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; hard, friable; many fine roots; about 10 percent, by volume, fragments of limestone less than 3 inches across and about 4 percent, by volume, from 3 to 5 inches across; few wormcasts; few fragments of shell; about 30 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear irregular boundary.

A12—5 to 12 inches; grayish brown (10YR 5/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; common fine roots; about 75 percent, by volume, fragments of limestone from 1/2 inch to 8 inches across the long axis; about 52 percent calcium carbonate equivalent; few concretions of calcium carbonate; few fragments of shell; calcareous; moderately alkaline; abrupt wavy boundary.

R—12 to 14 inches; indurated coarsely fractured limestone.

The solum thickness and depth to coarsely fractured indurated limestone range from 8 to 20 inches (fig. 14). Average content of fragments of limestone ranges from 5 to 50 percent in the A11 horizon and from 40 to 80 percent in the A12 horizon. The fragments are mostly less than 6 inches across the long axis. The calcium carbonate equivalent throughout the solum ranges from 40 to 80 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. The A11 horizon is clay loam or gravelly clay loam. The A12 horizon is very gravelly loam or very gravelly clay loam.

Altoga Series

The Altoga series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous, clayey sediment high in carbonates. Slope ranges from 2 to 5 percent.

Typical pedon of Altoga silty clay, 2 to 5 percent slopes; from the intersection of Interstate 35W and U.S. Highway 67, 3.8 miles east on U.S. Highway 67, 0.7 mile south on County Road 207, 150 feet east on County Road 109, and 2,360 feet south in a field:

Ap—0 to 4 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate fine granular and subangular blocky structure; slightly hard, friable; few fine roots; few calcium carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.

B2—4 to 22 inches; very pale brown (10YR 7/4) silty clay, brownish yellow (10YR 6/6) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine pores; common soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

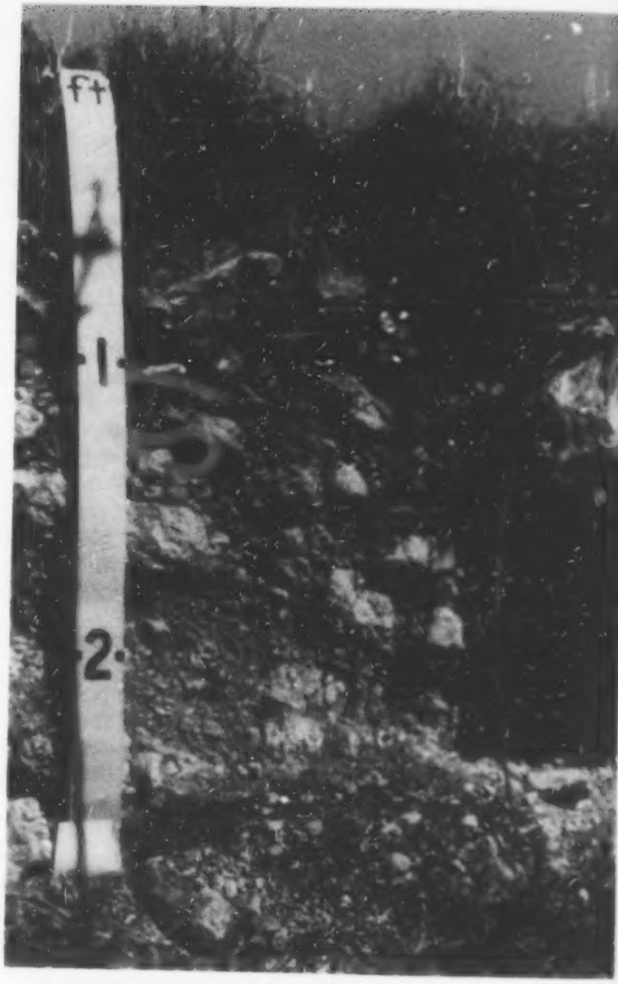


Figure 14.—Profile of Aledo soil underlain by fractured limestone bedrock, in an area of Aledo-Bolar complex, 2 to 8 percent slopes. The scale is in feet.

B3ca—22 to 37 inches; very pale brown (10YR 7/4) silty clay, brownish yellow (10YR 6/6) moist; weak fine subangular blocky structure; slightly hard, friable; few fine pores; many soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—37 to 62 inches; mottled, brownish yellow (10YR 6/6), yellowish brown (10YR 5/6), and very pale brown (10YR 7/3) shaly clay and sandstone; massive; extremely hard, extremely firm; calcareous; moderately alkaline.

The solum thickness ranges from 35 to 65 inches. The soil is silty clay, silty clay loam, or clay loam that has clay content of 25 to 35 percent. Total carbonates in the control section range from 40 to 75 percent. Visible accumulations of secondary lime are in the B horizon; the highest concentration is at a depth of about 22 inches. Coarse fragments consisting of rounded limestone and chert gravel range from none to about 5 percent.

The A horizon is grayish brown, light brownish gray, brown, pale brown, yellowish brown, light yellowish brown, or light olive brown. In some pedons the A horizon is less than 10 inches thick and has moist value and chroma of 3.5 or less.

The B and C horizons have hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 6.

Bastrop Series

The Bastrop series consists of deep, well drained, loamy soils on terraces. The soils formed in neutral to acid, loamy sediment. Slope ranges from 0 to 5 percent.

Typical pedon of Bastrop fine sandy loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 6 miles west on U.S. Highway 67, 10.9 miles south on Park Road 21, 1.7 miles west on County Road 1238, and 130 feet south in a field:

Ap—0 to 8 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; few fine roots; few pebbles of quartz; few wormcasts; slightly acid; clear smooth boundary.

B21t—8 to 30 inches; reddish brown (2.5YR 4/4) sandy clay loam, dark reddish brown (2.5YR 3/4) moist; moderate fine and medium subangular blocky structure; very hard, friable; few fine roots; many fine and very fine pores; few thin patchy clay films on faces of peds; few rounded pebbles of quartz; neutral; gradual smooth boundary.

B22t—30 to 48 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate coarse prismatic structure parting to moderate medium and coarse subangular blocky; very hard, friable; few fine pores; few thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

B23t—48 to 80 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; moderate coarse prismatic structure parting to weak coarse subangular blocky; very hard, friable; few rounded pebbles of quartz; neutral.

The solum thickness ranges from 60 to more than 90 inches. The content of pebbles of quartz ranges from none to about 15 percent. Clay content within the control section ranges from 20 to 35 percent.

The A horizon is brown, reddish brown, light reddish brown, light brown, pale brown, yellowish brown, dark grayish brown, grayish brown, strong brown, and light brownish gray. It is medium acid, slightly acid, or neutral.

The Bt horizon is strong brown, reddish brown, brown, red, light reddish brown, reddish yellow, or yellowish red. It is sandy clay loam, loam, or clay loam. The B21t horizon is slightly acid or neutral. The B22t horizon is medium acid to moderately alkaline, and in places it is calcareous below a depth of 60 inches.

The C horizon is light brown, reddish yellow, yellowish red, or light reddish brown. This horizon is sandy clay loam, clay loam, or loam that in places has some strata of sandy loam or loamy sand. In places secondary lime is in the form of films, threads, and concretions below a depth of 60 inches.

Birome Series

The Birome series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in stratified shale and sandstone that are high in iron content. Slope ranges from 5 to 20 percent.

Typical pedon of Birome stony fine sandy loam, in an area of Birome-Rayex complex, 5 to 20 percent slopes; from the intersection of Texas Highway 174 and Farm Road 917 in Joshua, 3.7 miles east on Farm Road 917, and 48 feet south of fence in rangeland:

A1—0 to 4 inches; brown (10YR 4/3) stony fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; common fine roots; few fine pores; many fragments of sandstone 1 inch to 5 inches across; neutral; gradual smooth boundary.

A2—4 to 6 inches; light yellowish brown (10YR 6/4) gravelly fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; hard, friable; common fine roots; many angular fragments of sandstone 1 inch to 4 inches across; slightly acid; abrupt smooth boundary.

B21t—6 to 17 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; common medium faint reddish yellow (7.5YR 6/6) and strong brown (7.5YR 5/6) mottles; moderate medium blocky structure; extremely hard, very firm; few fine and medium roots; many clay films on faces of peds; few fragments of sandstone 1 inch to 2 inches in diameter; strongly acid; gradual smooth boundary.

B22t—17 to 28 inches; reddish yellow (7.5YR 6/6) clay, strong brown (7.5YR 5/6) moist; common fine and medium distinct brownish yellow (10YR 6/6) and yellowish red (5YR 4/4) mottles; strong medium blocky structure; extremely hard, very firm; few medium roots; many clay films on faces of peds; strongly acid; gradual smooth boundary.

B3—28 to 35 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; few fine yellowish red mottles; weak coarse blocky structure; extremely hard, very firm; few medium roots; few clay films on faces of peds; strongly acid; gradual irregular boundary.

Cr—35 to 60 inches; weakly cemented fractured sandstone interbedded with pale olive (5Y 6/3) shaly clay.

The solum thickness ranges from 20 to 40 inches. Ironstone pebbles and thin fragments of sandstone ranging to as much as 20 inches in diameter cover 2 to 20 percent of the surface.

The A horizon is loam, fine sandy loam, gravelly fine sandy loam, loamy fine sand, stony fine sandy loam, and gravelly loamy fine sand. The A1 horizon is dark brown, brown, light reddish brown, grayish brown, pale brown, or dark grayish brown. The A2 sorizon is light yellowish brown, pinkish gray, light brown, pale brown, very pale brown, or light brownish gray. The A horizon is medium acid through neutral.

Flat and angular ironstone and sandstone fragments 0.1 inch to 3 inches in diameter make up 0 to 10 percent of the Bt horizon. The Bt horizon is strongly acid or medium acid. The B21t horizon is yellowish red, red, reddish yellow, reddish brown, and brown. The B22t horizon is reddish yellow, yellowish red, reddish brown, red, and light red. In places these horizons are mottled strong brown, pale brown, very pale brown, light yellowish brown, dark red, or red. The horizons are clay or sandy clay.

The B3 horizon has colors similar to those of the B2t horizons, or it is mottled red, yellowish red, strong brown, reddish yellow, pale brown, or light yellowish brown. It is clay, sandy clay, or clay loam and has 2 to 35 percent fragments of sandstone larger than 0.1 inch.

The Cr horizon is weakly cemented fractured sandstone interbedded with shale and clay. It is red, gray, or yellow.

Bolar Series

The Bolar series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in interbedded limestone and calcareous marls. Slope ranges from 1 to 20 percent.

Typical pedon of Bolar clay loam in an area of Aledo-Bolar complex, 2 to 8 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 4.8 miles west on U.S. Highway 67, 10 miles south on Farm Road 1434, and 82 feet east of road in rangeland:

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak fine subangular blocky structure; hard, friable; many fine roots; common fine pores; few concretions of calcium carbonate; few wormcasts; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, friable; common fine roots; few fine pores; common wormcasts; common concretions of calcium carbonate; few fragments of shell; few fragments of limestone in lower part which are remnants of a stone line; calcareous; moderately alkaline; clear smooth boundary.

B21ca—12 to 24 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; hard, friable; few fine roots; many wormcasts; many concretions of calcium carbonate; few soft masses of calcium carbonate; few small fragments of limestone; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—24 to 31 inches; very pale brown (10YR 7/3) clay loam, pale brown (10YR 6/3) moist; moderate fine granular structure; hard, friable; few fine roots; many concretions and soft masses of calcium carbonate; few limestone pebbles; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—31 to 36 inches; very pale brown (10YR 8/3) clay loam, very pale brown (10YR 7/3) moist; weak fine subangular blocky structure; hard, friable; many concretions and soft masses of calcium carbonate; common limestone pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

R—36 to 38 inches; indurated fractured limestone interbedded with calcareous marl.

The solum thickness ranges from 20 to 40 inches. Noncarbonate clay content of the 10- to 40-inch control section ranges from 20 to 35 percent. Fragments of limestone ranging to stone-sized and strongly cemented or indurated concretions of calcium carbonate make up 1 to 35 percent of the upper part of the solum. The B3 and R horizons, where present, are about 50 percent coarse fragments. The fragments are scattered throughout or are discontinuous remnants of stone lines of limestone or remnants of petrocalcic horizons. Calcium carbonate content of the 10- to 40-inch control section is 40 to 75 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, very dark brown, very dark gray, or dark brown. It is clay loam, gravelly clay loam, or stony clay loam.

The B horizon is light brown, brown, dark yellowish brown, dark grayish brown, pale brown, very pale brown, grayish brown, light brownish gray, light gray, yellowish brown, light yellowish brown, light olive brown, pale yellow, or yellow. It is clay loam, loam, or silty clay loam.

In a few places a B3 horizon is present.

The R layer is indurated fractured limestone that is interbedded with calcareous, clayey marl or shale.

Brackett Series

The Brackett series consists of shallow, well drained, loamy soils on uplands. These soils formed in interbedded soft limestone and marly earth. Slope ranges from 15 to 60 percent.

Typical pedon of Brackett loam in an area of Brackett-Rock outcrop complex, steep; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 13.3 miles west on U.S. Highway 67, 1.7 miles southwest on County Road 1119, 0.3 mile south on county road, and 388 feet east in rangeland:

A1—0 to 8 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; strong fine granular and subangular blocky structure; hard, friable; common fine grass roots; few medium roots; approximately 1 percent, by volume, fragments of limestone 0.2 inch to 3 inches across; many wormcasts; calcareous; moderately alkaline; clear wavy boundary.

B2—8 to 14 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; moderate fine and very fine subangular blocky structure; hard, friable; few fine and medium roots; common concretions and soft masses of calcium carbonate; few fragments of limestone 2 to 10 millimeters across; many wormcasts; calcareous; moderately alkaline; clear wavy boundary.

Cr—14 to 22 inches; interbedded weakly and strongly cemented limestone and light brownish gray (10YR 6/2) loam; few roots in vertical crevices.

The solum thickness ranges from 10 to 20 inches. Content of coarse fragments in the solum ranges from a few pieces of gravel-sized limestone to 35 percent, by volume, of platy, weakly to strongly cemented fragments of limestone as much as 5 inches across the long axis. The soil profile, including the Cr horizon, is 40 to more than 80 percent calcium carbonate, excluding fragments coarser than 20 millimeters.

The A horizon is brown, grayish brown, light yellowish brown, light brownish gray, pale brown, very pale brown, and light gray. It is loam, gravelly loam, gravelly clay loam, or clay loam.

The B horizon is grayish brown, brown, yellowish brown, light brownish gray, pale brown, light yellowish brown, light gray, very pale brown, or pale yellow. It is loam, gravelly loam, gravelly clay loam, or clay loam. Noncarbonate clay content is 10 to 30 percent.

The Cr horizon is light brownish gray, olive yellow, very pale brown, pale yellow, or white. Fragments of limestone or chalk make up 25 to 50 percent of the volume of the Cr horizon. The Cr horizon is made up of limy earths intermingled with limestone, calcareous silty shales, chalks, or marls that have bedding planes.

Burleson Series

The Burleson series consists of deep, moderately well drained, clayey soils on ancient stream terraces. These soils formed in alkaline, clayey sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Interstate 35W and Farm Road 916 in Grandview, 3.2 miles east on Farm Road 916, 1.6 miles north on County Road 205, and 124 feet north in a field:

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine granular and subangular blocky structure; extremely hard, very firm; few fine roots; few concretions of calcium carbonate; neutral; abrupt smooth boundary.

A11—5 to 21 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; extremely hard, very firm; few fine roots; few filled cracks with lighter colored Ap material; shiny pressure faces on peds; mildly alkaline; diffuse wavy boundary.

A12—21 to 44 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; common intersecting slickensides parting to moderate fine and medium blocky structure; extremely hard, very firm; shiny pressure faces on peds; few black concretions; few chert pebbles; mildly alkaline; diffuse wavy boundary.

AC1—44 to 58 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few fine faint very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) mottles; many intersecting slickensides parting to weak coarse blocky structure; extremely hard, very firm; few black concretions; few calcium carbonate concretions; calcareous; moderately alkaline; diffuse wavy boundary.

AC2—58 to 72 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few fine faint yellowish mottles; few intersecting slickensides parting to weak coarse blocky structure; extremely hard, very firm; few black concretions; common concretions of calcium carbonate; calcareous; moderately alkaline.

The A and AC horizons are cyclic, ranging from 40 to 100 inches thick, and generally exceed 48 inches in thickness. In virgin areas, gilgai microrelief consists of knolls ranging from 3 to 10 inches higher than the depressions; distance between the center of the knoll and the center of the depression is 5 to 15 feet. When this soil is dry, cracks 1 inch to 3 inches wide form and extend from the surface to depths of 25 to 60 inches or more. Intersecting slickensides begin at depths of 20 to 30 inches.

The A horizon is gray, dark gray, or very dark gray. When dry, it has a gray to light gray surface crust 1/16 to 1/2 inch thick. It is clay or silty clay. Reaction is medium acid through moderately alkaline. The A horizon is noncalcareous in the matrix. Thickness ranges from 6 to 20 inches on the microknolls and from 20 to 50 inches in the microdepressions.

The AC horizons are gray, dark gray, grayish brown, dark grayish brown, light olive gray, light brownish gray, and pale olive. They have few or common, faint or distinct brownish, yellowish or olive mottles in the upper part and become more distinctly mottled with depth. Matrix chromas of 1.5 or more are below a depth of 40 inches. The AC horizons are clay or silty clay and have 0 to 5 percent, by volume, siliceous pebbles. They are mildly alkaline or moderately alkaline and calcareous or noncalcareous.

Callisburg Series

The Callisburg series consists of deep, well drained, loamy soils on uplands. These soils formed in beds of clay and shaly clay. Slope ranges from 1 to 3 percent.

Typical pedon of Callisburg fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 4.8 miles west on U.S. Highway 67, 12 miles south on Farm Road 1434, 2.5 miles south on county road, and 135 feet west in rangeland:

A1—0 to 8 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; many fine roots; few siliceous pebbles; neutral; clear smooth boundary.

A2—8 to 14 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; common fine roots; few siliceous pebbles; neutral; abrupt smooth boundary.

B21t—14 to 24 inches; brown (7.5YR 5/4) sandy clay, dark brown (7.5YR 4/4) moist; common fine prominent red (2.5YR 4/8) and dark reddish brown (2.5YR 3/4) mottles; moderate medium blocky structure; very hard, firm; few fine roots; few fine pores; patchy clay films on faces of peds; common siliceous pebbles; slightly acid; gradual smooth boundary.

B22t—24 to 32 inches; strong brown (7.5YR 5.6) sandy clay, strong brown (7.5YR 5/6) moist; common medium prominent dark red (2.5YR 3/6) and yellowish red (5YR 4/6) mottles; moderate medium blocky structure; very hard, very firm; few fine roots; patchy clay films on faces of peds; common siliceous pebbles; medium acid; gradual smooth boundary.

B23t—32 to 42 inches; yellowish red (5YR 5/8) sandy clay, yellowish red (5YR 4/8) moist; common medium prominent dark red (2.5YR 3/6) and strong brown (7.5YR 5/6) mottles; weak coarse blocky structure; extremely hard, very firm; few fine roots; few black concretions; common siliceous pebbles; medium acid; gradual smooth boundary.

B3—42 to 68 inches; reddish yellow (7.5YR 6/6) sandy clay, strong brown (7.5YR 5/6) moist; common coarse prominent dark red (2.5YR 3/6) and yellowish red (5YR 4/8) mottles; weak coarse blocky structure; very hard, very firm; common soft masses of calcium carbonate; few black concretions; common siliceous pebbles; mildly alkaline; gradual smooth boundary.

C—68 to 74 inches; mottled yellowish red (5YR 4/8) and strong brown (7.5YR 5/6) gravelly sandy clay loam; massive; hard, friable; mildly alkaline.

The solum thickness ranges from 60 to 80 inches or more. Fine pebbles of quartz and chert range from none to about 5 percent, by volume, throughout the solum.

The A horizon is brown, light brown, dark grayish brown, yellowish brown, dark yellowish brown, pale brown, grayish brown, or strong brown (7.5YR 5/8). An A2 horizon, where present, is 2 to 6 inches thick and one or two units of value higher than the A1 or Ap horizon. The A horizon is medium acid through neutral.

The B horizon is strongly acid through mildly alkaline. In places soft carbonates are in the lower part of the B horizon, generally below a depth of 50 inches. The average clay content in the upper 20 inches of the Bt horizon ranges from 35 to 50 percent. The B21t horizon is brown, yellowish brown, brownish yellow, yellow, strong brown, reddish yellow, reddish brown, dark reddish brown, or dark red. The B22t and B23t horizons are brownish yellow, yellowish brown, light yellowish brown, reddish yellow, strong brown, brown, light olive brown, or yellowish red. Few to common mottles in shades of red, yellow, brown, and gray are in the B2t horizon. The gray mottles may be inherited from the shaly clay parent material. The B22t and B23t horizons are sandy clay or clay. The B3 horizon has colors similar to those of the Bt horizon, or it is mottled.

This soil is considered a taxadjunct to the Callisburg series because it is outside the normal geographical area and because it does not have pockets of uncoated sand grains in the lower part of the Bt horizon.

Coving Series

The Coving series consists of deep, somewhat poorly drained, sandy soils on uplands. These soils formed in loamy and sandy sediments that were reworked by wind. Slope ranges from 0 to 3 percent.

Typical pedon of Coving loamy fine sand, 0 to 3 percent slopes; from the intersection of Texas Highway

174 and Farm Road 1718 in Cleburne, 0.7 mile south on Texas Highway 174, 7.7 miles southeast on Texas Highway 171, 0.4 mile west on Farm Road 916, and 406 feet in pasture:

A1—0 to 8 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; many fine roots; neutral; clear smooth boundary.

A2—8 to 31 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; few fine faint light brownish gray (10YR 6/2) mottles; single grained; loose, very friable; few fine roots; slightly acid; clear wavy boundary.

B21t—31 to 44 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; common medium distinct mottles of strong brown (7.5YR 5/6); few fine faint grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; medium acid; gradual wavy boundary.

B22t—44 to 62 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common medium prominent mottles of strong brown (7.5YR 5/8, 5/6) and dark red (2.5YR 3/6); moderate medium subangular blocky structure; hard, firm; slightly acid; gradual wavy boundary.

B3—62 to 80 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many coarse prominent mottles of strong brown (7.5YR 5/8), dark red (2.5YR 3/6), and gray (10YR 6/1); weak coarse subangular blocky structure; hard, firm; slightly acid.

The solum thickness ranges from 60 to more than 80 inches. The clay content of the upper 20 inches of the Bt horizon ranges from 18 to 30 percent.

The A horizon ranges from 20 to 40 inches in thickness. The Ap or A1 horizon is pale brown, brown, or light brown and ranges from slightly acid to neutral. The A2 horizon is light yellowish brown, brown, pale brown, light brown, or pink and has mottles of light brown and grayish brown.

The B21t horizon is mottled light yellowish brown, strong brown, light gray, gray, pale brown, brownish yellow, yellow, red, or reddish brown. It is sandy clay loam, loam, or clay loam. Reaction ranges from medium acid to mildly alkaline. The B22t horizon is mottled light gray, strong brown, light olive brown, olive yellow, very dark grayish brown, light yellowish brown, brownish yellow, yellow, reddish yellow, or red. It is sandy clay loam or clay loam. Reaction ranges from slightly acid to mildly alkaline. The B3 horizon has mottles of light gray, strong brown, red, gray, light olive gray, brown, brownish yellow, and reddish yellow. It is sandy clay loam or clay loam. Reaction ranges from slightly acid through moderately alkaline.

Crosstell Series

The Crosstell series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in stratified clay, shale, and weakly cemented sandstone. Slope ranges from 1 to 8 percent.

Typical pedon of Crosstell fine sandy loam, 3 to 8 percent slopes; from the intersection of Texas Highway 174 and Farm Road 110 in Cleburne, 1.7 miles east on Farm Road 110, 5.9 miles northeast on Farm Road 3136, 0.8 mile south on private road, and 36 feet north of large mesquite tree in rangeland:

A—0 to 5 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; few siliceous pebbles; slightly acid; abrupt smooth boundary.

B21t—5 to 20 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; few fine faint yellowish and reddish mottles; moderate coarse blocky structure; extremely hard, very firm; common fine roots; few fine tubular pores; nearly continuous clay films on ped faces; few ironstone and sandstone pebbles; strongly acid; gradual smooth boundary.

B22t—20 to 30 inches; brownish yellow (10YR 6/8) clay, yellowish brown (10YR 5/8) moist; common medium prominent red (2.5YR 4/6) mottles; moderate medium blocky structure; extremely hard, extremely firm; few fine roots; few fine tubular pores; nearly continuous clay films on ped faces; many ironstone and sandstone pebbles; medium acid; gradual smooth boundary.

B23t—30 to 41 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; many coarse prominent red (2.5YR 4/8, 4/6) mottles; moderate coarse blocky structure; extremely hard, extremely firm; few fine roots; few patchy clay films on faces of peds; common black concretions; few ironstone and sandstone pebbles; medium acid; gradual smooth boundary.

B3—41 to 51 inches; coarsely and prominently mottled red (2.5YR 4/6), dark red (2.5YR 3/6), brownish yellow (10YR 6/8), yellowish brown (10YR 5/8), and light gray (10YR 7/2) clay; weak coarse blocky structure; extremely hard, extremely firm; few fine roots along faces of peds; many fine black concretions; common coatings of light gray (10YR 7/2) fine sand; slightly acid; gradual smooth boundary.

C—51 to 76 inches; coarsely and prominently mottled light gray (10YR 7/1), gray (10YR 6/1), reddish yellow (5YR 6/6), yellowish red (5YR 5/6), and strong brown (7.5YR 5/8) shaly clay; massive with cleavage planes showing in some parts; extremely hard, very firm; weakly cemented sandstone interbedded with shaly clay at a depth of about 70 inches; mildly alkaline.

The solum thickness ranges from 40 to 60 inches. Coarse fragments range from few to common throughout. Potential linear extensibility exceeds 6 centimeters.

The A horizon is brown, pinkish gray, light brown, dark grayish brown, grayish brown, yellowish brown, light brownish gray, pale brown, or light yellowish brown. Reaction ranges from medium acid to mildly alkaline. A thin A2 horizon, where present, ranges from 1 inch to 4 inches thick and is about 1 to 2 units higher in value than the A1 or Ap horizon.

The B21t horizon has clay content ranging from 40 to 60 percent in the upper 20 inches. The B21t horizon is reddish brown, light reddish brown, reddish yellow, yellowish red, red, brown, light brown, or reddish yellow. Mottles of those colors and yellow, dark grayish brown, and olive are in most pedons. Reaction is very strongly acid or strongly acid, but in places it is medium acid.

The B22t horizon has colors similar to those of the B21t horizon and, in addition, has yellowish brown, light yellowish brown, brownish yellow, very pale brown, and yellow. Reaction ranges from strongly acid to mildly alkaline.

The B23t and B3 horizons have a color range similar to that of the upper part of the B2t horizon and, in addition, have light olive brown and light yellowish brown. Mottles are light brownish gray, pale brown, light yellowish brown, light gray, very pale brown, white, pale olive, and olive yellow. Reaction ranges from medium acid to moderately alkaline.

The C horizon is stratified clay, shaly clay, shale, and weakly cemented sandstone. Reaction is neutral to moderately alkaline.

Culp Series

The Culp series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in loamy and clayey sediments. Slope ranges from 0 to 3 percent.

Typical pedon of Culp clay loam, 0 to 3 percent slopes; from the intersection of Texas Highway 171 and Texas Highway 174 in Cleburne, 2.9 miles northwest on Texas Highway 171, 2.6 miles north on County Road 1017, 0.6 mile east on County Road 904, and 358 feet south in a field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, friable; few fine roots; few ironstone pebbles; few siliceous pebbles; neutral; clear smooth boundary.

B21t—6 to 16 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; few faint reddish mottles; moderate medium blocky structure; very hard, very firm; few fine roots; few fine tubular pores; common clay films on ped faces; few cracks filled with Ap material; few siliceous and ironstone pebbles; neutral; gradual smooth boundary.

B22t—16 to 32 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; few faint yellowish and reddish mottles; moderate medium blocky structure; very hard, very firm; few fine tubular pores; few shiny pressure faces on peds; continuous clay films on faces of peds; few siliceous and ironstone pebbles; mildly alkaline; gradual smooth boundary.

B23—32 to 44 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; few faint reddish and yellowish mottles; moderate coarse blocky structure; very hard, very firm; common patchy clay films on faces of peds; few ironstone pebbles; few calcium carbonate concretions; few black concretions; few cracks filled with darker material; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—44 to 61 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; common fine distinct yellowish brown (10YR 5/4) and brownish yellow (10YR 6/8) mottles; weak coarse blocky structure; very hard, very firm; many concretions and soft masses of calcium carbonate; few pebbles of ironstone; few black concretions; calcareous; moderately alkaline; gradual smooth boundary.

C—61 to 72 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; common fine faint very pale brown (10YR 8/4) and yellowish brown (10YR 5/6) mottles; hard, firm; common concretions and soft masses of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The solum thickness ranges from 50 to 80 inches or more. Pebbles throughout range from few to common. In places a few pebbles ranging to as much as 2 inches in diameter are on the surface. Secondary calcium carbonate is below a depth of 40 inches.

The A horizon ranges to as much as 14 inches in thickness and is dark grayish brown, very dark grayish brown, and dark brown. It is neutral or mildly alkline.

Average clay content of the upper 20 inches of the Bt horizon ranges from 35 to 50 percent. The B21t horizon is very dark gray, dark gray, dark grayish brown, very dark grayish brown, dark brown, dark reddish brown, and dark reddish gray and has mottles of reddish yellow, dark reddish gray, reddish brown, dark brown, brown, or light yellowish brown. This horizon is clay, sandy clay loam, or clay loam. Reaction ranges from neutral to moderately alkaline. The matrix of the B22t horizon is olive, dark grayish brown, very dark grayish brown, brown, and yellowish brown. This horizon has mottles in shades of red, yellow, gray, and brown. The B23t horizon has mottles of olive brown, yellow, or gray.

The B3ca horizon is mottled olive, yellow, gray, or brown.

The C horizon is mottled brown, yellow, gray, and olive. It is mildly alkaline or moderately alkaline and calcareous.

Decordova Series

The Decordova series consists of deep, well drained, sandy soils on terraces of the Brazos River. These soils formed in sandy alluvium that has been reworked by wind. Slope ranges from 0 to 5 percent.

Typical pedon of Decordova loamy fine sand, 0 to 5 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 6 miles west on U.S. Highway 67, 6.4 miles south on Park Road 21, 4.5 miles south on Farm Road 1434, 1.8 miles west on County Road 1238 to its end, and 336 feet west in field:

Ap—0 to 10 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak fine granular structure; loose, very friable; few siliceous pebbles; neutral; clear smooth boundary.

B21t—10 to 36 inches; yellowish red (5YR 4/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine granular; slightly hard, friable; common fine tubular pores; common fine and very fine siliceous pebbles; slightly acid; gradual smooth boundary.

B22t—36 to 58 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine granular; slightly hard, friable; few clean sand grains; common very fine siliceous pebbles; slightly acid; gradual smooth boundary.

B3—58 to 72 inches; yellowish red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; weak medium subangular blocky structure; slightly hard, friable; few very fine siliceous pebbles; slightly acid.

The solum thickness is more than 60 inches. Small siliceous pebbles range from none to about 10 percent by volume.

The A horizon is light brown, brown, or dark brown. Reaction is medium acid to neutral.

The Bt horizon is yellowish red, reddish yellow, strong brown, red, or reddish brown. It is fine sandy loam or loam that has clay content of less than 18 percent. The Bt horizon is medium acid to neutral. Some pedons are moderately alkaline and calcareous in the lower part.

Denton Series

The Denton series consists of moderately deep, well drained, clayey soils on uplands. These soils formed in fractured indurated limestone and interbedded marl. Slope ranges from 1 to 3 percent.

Typical pedon of Denton silty clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 13.7 miles west on U.S. Highway 67, 0.2 mile southwest on County Road 1119, 2.6 miles south and west on County Road 1234, and 324 feet south in a field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A11—8 to 21 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; common concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

A12—21 to 32 inches; brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate medium angular blocky structure; very hard, very firm, sticky and plastic; few fine roots; common concretions of calcium carbonate; few shell fragments; calcareous; moderately alkaline; abrupt irregular boundary.

Cca—32 to 38 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; massive; very hard, firm; many concretions of calcium carbonate; approximately 60 percent, by volume, limestone fragments 1/2 inch to 4 inches across; calcareous; moderately alkaline; abrupt irregular boundary.

R—38 to 41 inches; indurated fractured limestone.

The solum thickness ranges from 22 to 40 inches. Fragments of limestone less than 3 inches in diameter make up from 0 to 20 percent of the soil mass.

The A horizon is dark grayish brown, brown, very dark brown, dark brown, or very dark grayish brown. The mollic epipedon ranges from 16 to 35 inches in thickness.

The B horizon, where present, is brown, yellowish brown, dark yellowish brown, dark brown, pale brown, light yellowish brown, light brownish gray, grayish brown, or light olive brown. The B horizon is silty clay, clay, or silty clay loam. In places stone lines are present. Carbonates including coarse fragments less than 3 inches across range from 15 to 40 percent of the fine earth fractions in the B horizon and in places in the lower part of the A horizon. The B horizon has 5 percent more secondary carbonates than the upper part of the A horizon.

The R layer ranges from fractured limestone bedrock interbedded with calcareous clayey marl to beds of limestone rubble with clayey marl filling the interstices.

Ferris Series

The Ferris series consists of deep, well drained, clayey soils on uplands. These soils formed in weakly consolidated formations of calcareous marine sediment that is high in montmorillonitic clays. Slope ranges from 2 to 12 percent.

Typical pedon of Ferris clay in the Ferris-Heiden complex, 2 to 5 percent slopes; from the intersection of Interstate 35W and U.S. Highway 67, 4.8 miles east on U.S. Highway 67, 1.6 miles north on Farm Road 2738, 0.9 mile east on gravel road, and 127 feet south in a field:

Ap—0 to 10 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; weak fine granular structure; very hard, very firm; few fine roots; few small chert pebbles; few concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

AC—10 to 45 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; few faint yellowish brown mottles; moderate medium blocky structure; very hard, very firm; few fine roots; common intersecting slickensides; common concretions of calcium carbonate; few small chert pebbles; common soft white calcium carbonate masses; few black concretions; few fragments of shells; few cracks filled with darker material from the surface; calcareous; moderately alkaline; gradual wavy boundary.

C—45 to 60 inches; mottled light gray (10YR 7/1), brownish yellow (10YR 5/8), yellowish red (5YR 5/8), and dark yellowish brown (10YR 4/4) shaly clay; massive; very hard, very firm; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches or more in thickness. It is clay or silty clay. Clay content ranges from 40 to 60 percent. In places smooth gravel is on the surface. When the soil is dry, cracks form which extend to a depth of more than 20 inches. These cracks remain open 90 to 150 cumulative days in most years.

The A horizon is very dark grayish brown, dark grayish brown, light olive gray, pale olive, grayish brown, light brownish gray, brown, light yellowish brown, light olive brown, olive brown, olive gray, or olive. The lower values and chromas are where the A horizon is thickest. In places where the moist color value of the A horizon is less than 3.5, the horizon is less than 12 inches thick.

The AC horizon is light olive brown, light yellowish brown, light brownish gray, grayish brown, light gray, olive gray, light olive gray, olive, pale olive, or olive yellow. In some pedons mottles are not present in the upper part of the AC horizon. Gray mottles, where present, are probably inherited from the shale. Concretions of calcium carbonate range from few to many in the AC and C horizons. Total carbonates range from 2 to 35 percent. In places gypsum crystals are in the C horizon.

The C horizon is light gray, light brownish gray, light olive brown, light yellowish brown, pale yellow, olive, pale olive, pale brown, yellowish brown, or yellow. This horizon generally has coarse and prominent mottles. It is strongly weathered, shaly clay or calcareous shale.

Frio Series

The Frio series consists of deep, well drained, clayey soils on flood plains. These soils formed in calcareous, clayey and loamy alluvium. Slope ranges from 0 to 1 percent.

Typical pedon of Frio silty clay, occasionally flooded; from the intersection of Texas Highway 171 and Farm Road 2435 in Godley, 4.5 miles northwest on Texas Highway 171, 2.6 miles west on ranch road, and 405 feet south in a field:

A11—0 to 18 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; strong fine granular and subangular blocky structure; hard, firm, sticky and plastic; common fine and medium roots; common fine concretions of calcium carbonate; few fragments of limestone from 3/4 inch to 3 inches across; common wormcasts; calcareous; moderately alkaline; diffuse smooth boundary.

A12—18 to 37 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; hard, firm, sticky and plastic; few fine and medium roots; common fine concretions of calcium carbonate; few fragments of shells; calcareous; moderately alkaline; gradual smooth boundary.

Cca—37 to 60 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; massive; hard, firm, sticky and plastic; thin strata of 1/4 to 1 inch limestone gravel in the upper part; few fragments of shell; calcareous; moderately alkaline.

The calcium carbonate equivalent of the 10- to 40-inch control section ranges from 10 to 40 percent. The COLE in the upper 50 inches of the soil ranges from .030 to .069. Depth to gravel or limestone ranges from 6 to 30 feet.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. The 10- to 40-inch control section is silty clay, silty clay loam, or clay loam; it is 35 to 50 percent clay.

In some pedons strata of more loamy or more clayey sediment are at depths of between 30 and 50 inches. In some pedons the control section is 5 to 15 percent, by volume, pebbles and cobbles of limestone.

Gaddy Series

The Gaddy series consists of deep, somewhat excessively drained, sandy soils on flood plains. These soils formed in calcareous, sandy alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Gaddy loamy fine sand in an area of Yahola-Gaddy complex, occasionally flooded; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 5 miles west on U.S. Highway 67, 11.1 miles south on Park Road 21 and farm Road 1434, 2.1 miles west on County Road 1238 to gate, 0.6 mile west on private road, and 20 feet west of road in rangeland:

A1—0 to 8 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; weak fine granular structure; slightly hard, very friable; many fine and medium roots; calcareous; moderately alkaline; gradual smooth boundary.

C1—8 to 19 inches; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose; common fine and medium roots; calcareous; moderately alkaline; gradual smooth boundary.

C2—19 to 60 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots in upper part; thin strata of pale brown (10YR 6/3) very fine sandy loam, brown (7.5YR 4/4) silt loam, brown (10YR 4/3) silty clay, and dark yellowish brown (10YR 4/4) very fine sandy loam; calcareous; moderately alkaline.

The Ap or A1 horizon is light yellowish brown, brown, light brown, reddish yellow, grayish brown, pale brown, or dark yellowish brown. It is loamy fine sand, fine sandy loam, or silt loam. Reaction is mildly alkaline or moderately alkaline.

The C horizon is very pale brown, light brown, pale brown, light yellowish brown, pink, reddish yellow, brownish yellow, or yellow. It is loamy fine sand or fine sand and has thin strata of finer or coarser soil material. The C horizon is calcareous and moderately alkaline.

Gasil Series

The Gasil series consists of deep, well drained, loamy and sandy soils on uplands. These soils formed in loamy material and interbedded sandstone. Slope ranges from 0 to 8 percent.

Typical pedon of Gasil fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highways 174 and 171 in Cleburne, 3.8 miles southeast on Texas Highway 171, and 1,900 feet east in a field:

Ap—0 to 8 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine roots; few pebbles of ironstone; slightly acid; clear smooth boundary.

B21t—8 to 32 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; few fine distinct yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; hard, firm; common fine roots; common fine pores; few fine pebbles of ironstone; slightly acid; gradual smooth boundary.

B22t—32 to 52 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common medium prominent red (2.5YR 4/6) and brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; hard, firm; few fine roots; few fine pores; few fine pebbles of ironstone; medium acid; gradual smooth boundary.

B23t—52 to 75 inches; coarsely and prominently mottled yellowish brown (10YR 5/8), red (2.5YR 4/6), light gray (2.5Y 7/2), and strong brown (7/5YR 5/8) sandy clay loam; moderate coarse prismatic parting to weak fine and medium subangular blocky structure; hard, firm; few fine roots; few fine pebbles of ironstone; coatings of fine sand on peds and few pockets of uncoated sand grains that are white (2.5Y 8/2); medium acid.

The solum thickness ranges from 60 to 100 inches or more. Fine pebbles of ironstone and fragments of sandstone range from none to about 5 percent throughout the solum (fig. 15).

The A horizon ranges from 6 to 20 inches. It is fine sandy loam or loamy fine sand. Reaction ranges from slightly acid through mildly alkaline. The Ap horizon is pale brown, brown, light yellowish brown, yellowish brown, light brownish gray, or dark yellowish brown. The A2 horizon is one to two units of value higher than the Ap horizon.

The B2t horizon is yellowish brown, brown, strong brown, reddish yellow, light yellowish brown, brownish yellow, very pale brown, or yellow. Few to common mottles in shades of red, yellow, and brown are in the B2t horizon. The B2t horizon is sandy clay loam, loam, or fine sandy loam. Clay content in the upper 20 inches ranges from 18 to 30 percent. The B2t horizon ranges from strongly acid to slightly acid.

Gowen Series

The Gowen series consists of deep, well drained, loamy soils on flood plains. These soils formed in loamy sediment that is dominantly from noncalcareous soils. Slope ranges from 0 to 1 percent.

Typical pedon of Gowen clay loam, frequently flooded; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 8.2 miles east on U.S. Highway 67, 0.4 mile south on private lane to gate, and 1,810 feet south in native pasture:

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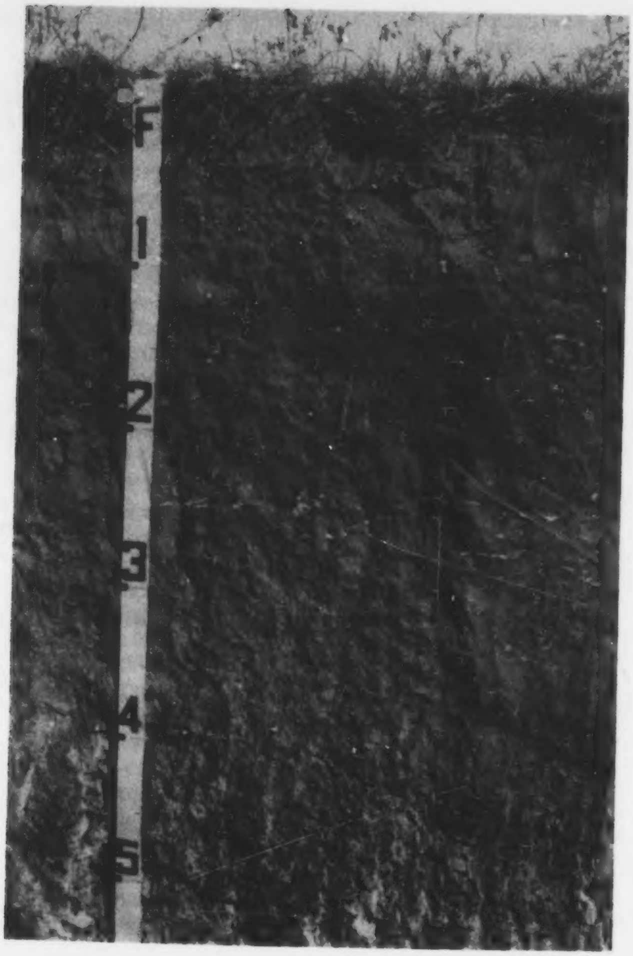

Figure 15.—Profile of Gasil fine sandy loam, 1 to 3 percent slopes, that has few fine pebbles of ironstone throughout. The scale is in feet.

A11—0 to 20 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; common fine and medium roots; common fine and medium pores; thin layer of darker clayey material present in lower part; very thin strata of sandy material present in lower part; neutral; clear smooth boundary.

A12—20 to 38 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; hard, firm; common fine and medium roots; many fine and medium pores; many discontinuous strata of sandy material in lower part; neutral; gradual smooth boundary.

C1—38 to 56 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; very hard, friable; few fine roots; common fine and few medium pores; few thin strata of sandy material and one pocket of sandy material present in lower part; neutral; gradual wavy boundary.

C2—56 to 72 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable; few fine and medium roots; common fine and medium pores; few pockets of sandy material present in upper part; neutral.

Where the surface layer has moist color values of less than 3.5 and evident structure, the horizon ranges in thickness from 24 to about 50 inches. The clay content of the 10- to 40-inch control section averages between 22 and 35 percent clay, and more than 15 percent is coarser than very fine sand. Reaction ranges from neutral to moderately alkaline.

The A horizon, when dry, is very dark gray, dark gray, gray, very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. The A12 and C horizons are loam or clay loam. Thin strata of fine sandy loam and clay are in the C horizon.

In some places a thin B2 horizon is below a depth of 24 inches.

The C horizon is yellowish brown, light yellowish brown, dark yellowish brown, dark brown, brown, dark grayish brown, or very dark grayish brown.

Hassee Series

The Hassee series consists of deep, somewhat poorly drained, loamy soils on uplands. These soils formed in alkaline, clayey sediment. Slope ranges from 0 to 1 percent.

Typical pedon of Hassee fine sandy loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 67 and Spur 102 in Keene, 2 miles east on U.S. Highway 67, 1.4 miles north on County Road 807, 0.1 mile east on County Road 703, and 360 feet north in a field:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; very hard, friable; few fine roots; few wormcasts; neutral; clear smooth boundary.

A2g—9 to 14 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; very hard, friable; few fine roots; neutral; abrupt smooth boundary.

B21tg—14 to 21 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; common fine faint yellowish red (5YR 4/6) mottles; strong medium blocky structure; extremely hard, extremely firm; few fine roots; continuous clay films on faces of peds; few siliceous pebbles; neutral; gradual smooth boundary.

B22tg—21 to 37 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few fine faint reddish mottles; moderate medium blocky structure; extremely hard, extremely firm; few fine roots following faces of peds; common shiny pressure faces; continuous clay films on faces of peds; few black concretions; few siliceous pebbles; mildly alkaline; gradual smooth boundary.

B3gca—37 to 54 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few fine faint yellowish mottles; weak fine blocky structure; very hard, very firm; few fine concretions of calcium carbonate; few black concretions; calcareous; moderately alkaline; gradual smooth boundary.

Cca—54 to 72 inches; distinctly mottled light gray (10YR 7/2), grayish brown (10YR 5/2), yellowish brown (10YR 5/6), and strong brown (7.5YR 4/6) clay; massive; very hard, very firm; common concretions of calcium carbonate; common black concretions; calcareous; moderately alkaline.

The solum thickness ranges from 40 to 72 inches. When the soil is dry, the A horizon is hard or very hard and massive.

The A horizon has hue of 10YR, value of 3 through 5, and chroma of 2. The A2g horizon has hue of 10YR, value of 5 through 7, and chroma of 1 or 2. Reaction is slightly acid or neutral.

The B2tg horizon has hue of 10YR, value of 3 to 5, and chroma of 1 or 2. Mottles in shades of red, brown, or yellow range from none to common. The B2tg horizon is clay or silty clay. Reaction ranges from slightly acid to moderately alkaline and calcareous. Soft masses and concretions of calcium carbonate are below a depth of 28 inches.

The B3gca and Cca horizons are in shades of gray and brown. They are clay loam or clay. These horizons are calcareous and reaction ranges from neutral to moderately alkaline. Masses and concretions of calcium carbonate range from few to common. In some pedons a few pebbles of quartz, chert, or ironstone are present.

Heiden Series

The Heiden series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous marine sediment. Slopes range from 1 to 8 percent.

Typical pedon of Heiden clay, 1 to 3 percent slopes; from the intersection of Interstate 35W and U.S. Highway 67, 4.8 miles south on Interstate 35W to Greenfield exit, 1.8 miles south on frontage road, and 48 feet west in a field:

Ap—0 to 5 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine granular structure and moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; few fine pores; few concretions of calcium carbonate; few limestone pebbles 1 centimeter to 3 centimeters in size; few pebbles of quartz; calcareous; moderately alkaline; abrupt smooth boundary.

A11—5 to 14 inches; very dark grayish brown (2.5Y 3/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine roots; few fine pores; few intersecting slickensides in lower part; few concretions of calcium carbonate; few black concretions; few limestone pebbles 1 centimeter to 3 centimeters in size; few quartz pebbles; common cracks filled with very dark gray (10YR 3/1) material; calcareous; moderately alkaline; diffuse wavy boundary.

A12—14 to 34 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate medium angular blocky structure; extremely hard, very firm, very sticky and very plastic; few fine pores; common intersecting slickensides; few concretions of calcium carbonate; few black concretions; few limestone pebbles 1 centimeter to 2 centimeters in size; few quartz pebbles; common cracks filled with very dark gray (10YR 3/1) material; calcareous; moderately alkaline; diffuse wavy boundary.

AC—34 to 62 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; few fine faint yellowish mottles; weak coarse angular blocky structure; extremely hard, very firm, very sticky and very plastic; many intersecting slickensides; many concretions and soft masses of calcium carbonate; few black concretions; few quartz pebbles; calcareous; moderately alkaline; diffuse wavy boundary.

C—62 to 80 inches; light yellowish brown (2.5Y 6/4) shaly clay, light olive brown (2.5Y 5/4) moist; common fine faint grayish brown (2.5Y 5/2) mottles; massive; extremely hard, very firm, very plastic; many concretions and soft masses of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The solum ranges from 40 to 65 inches in thickness and includes the A and AC horizons. Pedons are thinnest on the microknolls or ridges and thickest in the microdepressions or valleys. Heiden soils are clay and silty clay throughout, and the clay content ranges from 40 to 60 percent. Coarse slickensides are common below a depth of 20 inches. When the soil is dry, cracks ranging to as much as 4 inches in width form at the surface and extend into the lower part of the AC horizon.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, very dark gray, dark gray, dark olive gray, olive gray, or olive. Where chroma is less than

1.5, the surface layer is less than 12 inches thick. The horizon is dominantly calcareous and moderately alkaline but ranges to noncalcareous and mildly alkaline in the upper 12 inches.

The AC horizon is grayish brown, olive, olive gray, or yellowish brown. It is 1 to 2 units of value higher than values of the A horizons and is mottled with those colors or is with or without yellowish or olive mottles. Concretions of calcium carbonate range from few to about 2 percent by volume.

The C horizon is clay or strongly weathered shaly clay ranging to slightly weathered calcareous shales. The structure of the C horizon is intermingled soil and rock.

Hensley Series

The Hensley series consists of shallow, well drained, loamy soils on uplands. These soils formed mainly from residuum from Lower Cretaceous limestone. Slope ranges from 1 to 3 percent.

Typical pedon of Hensley clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 916 and Texas Highway 174 in Rio Vista, 0.3 mile south on Texas Highway 174, 0.1 mile west on County Road 1106, and 78 feet north in pasture:

A1—0 to 5 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky and granular structure; hard, firm; many fine roots; few ironstone pebbles; mildly alkaline; clear smooth boundary.

B2t—5 to 16 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate fine angular blocky structure; very hard, very firm; few fine roots; thin continuous clay films on faces of peds; common ironstone pebbles; mildly alkaline; abrupt smooth boundary.

R—16 to 18 inches; indurated limestone bedrock; slightly fractured.

The solum thickness and depth to bedrock range from 10 to 20 inches. The average clay content from the soil surface to bedrock is more than 35 percent if the solum is less than 14 inches thick.

The A horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 4 or 5; and chroma of 2 to 4. Fragments of limestone and ironstone 0.1 inch to 3 inches across range from 0 to 15 percent by volume. Reaction ranges from slightly acid through mildly alkaline.

The Bt horizon has hue of 2.5YR, value of 3 or 4, and chroma of 4 to 6. Moist values are 3 or less. The horizon is clay loam or clay that has clay content of 35 to 55 percent. Fragments of limestone and ironstone 0.1 inch to 8 inches across range from 0 to 10 percent by volume. Reaction ranges from neutral to moderately alkaline. The underlying material is thick beds of fractured limestone bedrock.

Houston Black Series

The Houston Black series consists of deep, moderately well drained, clayey soils on uplands. These soils formed in calcareous clays and marls. Slope ranges from 0 to 3 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Farm Road 157 in Venus, 2.4 miles north on Farm Road 157, 0.9 mile southwest on County Road 616, and 124 feet east of road in an idle field:

A11—0 to 8 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine granular and moderate fine subangular blocky structure; very hard, very firm, very sticky and plastic; many fine and medium roots; few fine pores; common wormcasts; few shiny ped faces; calcareous; moderately alkaline; abrupt smooth boundary.

A12—8 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine angular blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few fine pores; few intersecting slickensides in lower part; few concretions of calcium carbonate; few fragments of shell; few quartz pebbles; few cracks filled with darker material from above layer; calcareous; moderately alkaline; gradual wavy boundary.

A13—20 to 34 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common intersecting grooved slickensides; many shiny faces on peds; common concretions of calcium carbonate; few soft masses of calcium carbonate; few black concretions; few cracks filled with darker material; few quartz pebbles; calcareous; moderately alkaline; clear wavy boundary.

AC1—34 to 52 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; few brownish and faint yellowish mottles; strong coarse angular blocky structure; extremely hard, very firm, plastic; common intersecting slickensides; common threads of calcium carbonate; few soft masses of calcium carbonate; few quartz pebbles; few fragments of shell; calcareous; moderately alkaline; gradual wavy boundary.

AC2—52 to 72 inches; coarsely and distinctly mottled grayish brown (2.5Y 5/2), dark grayish brown (2.5Y 4/2), light yellowish brown (2.5Y 6/4), and yellowish brown (10YR 5/8) clay; weak medium angular blocky structure; extremely hard, very firm, plastic; many films and threads of calcium carbonate; few concretions of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The combined thickness of the A and AC horizons ranges from about 60 to more than 100 inches. When the soil is dry, cracks form that range from 0.4 inch to 4 inches in width and extend to a depth of 20 inches. Intersecting slickensides begin at depths ranging from about 16 to 24 inches below the surface. The soil is clayey throughout; the dominant textures are clay or silty clay. When the surface is dry, it is covered with a granular mulch of extremely hard, discrete granules that is about 1/2 inch thick. Cycles of microdepressions and microknolls are repeated each 10 to 24 feet. In virgin areas, microknolls are 3 to 18 inches higher than microdepressions. Chroma is less than 1.5 to depths of 30 to 60 inches in the center of the microdepressions and to depths of 10 to 18 inches in the center of microknolls. The extremes of amplitude or waviness of the boundary between the A and AC horizons range from about 20 to 48 inches from the center of the microknoll to the center of the microdepression.

The A horizons are black, very dark gray, dark gray, or gray. The soil is moderately alkaline and calcareous; however, reaction in the center of the microdepressions ranges from mildly alkaline to moderately alkaline in some pedons.

The upper part of the AC horizon ranges from dark grayish brown to olive or yellow in microknolls that have hue of 10YR through 5Y. In some pedons common to many medium mottles are gray, brown, olive, and yellow. The lower part of the AC horizon ranges from dark grayish brown to light brownish gray and has olive, brown, and yellow mottles, or it ranges from olive or yellow and has gray mottles.

Krum Series

The Krum series consists of deep, well drained, clayey soils on uplands. These soils formed in thick beds of unconsolidated, calcareous, clayey sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Krum silty clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 6 miles west on U.S. Highway 67, 7.4 miles south on Park Road 21, and 66 feet east in pasture:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, firm, sticky and plastic; many fine roots; few fine pores; few wormcasts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 34 inches; dark brown (7.5YR 3/2) silty clay, dark brown (7.5YR 3/2) moist; moderate very fine subangular blocky structure and moderate fine angular blocky; hard, firm, sticky and plastic; few fine roots; few fine concretions of calcium carbonate; few fragments of shell; calcareous; moderately alkaline; gradual wavy boundary.

B2—34 to 52 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; moderate medium angular blocky structure; very hard, very firm, sticky and plastic; few cracks partly filled with very dark grayish brown (10YR 3/2) material; common concretions of calcium carbonate; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—52 to 62 inches; light brown (7.5YR 6/4) silty clay, brown (7.5YR 5/4) moist; massive; very hard, firm, sticky and plastic; many concretions, threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 38 to 70 inches. When the soil is dry, cracks ranging from 0.4 inch to as much as 1.2 inches in width extend to depths of about 24 to 48 inches. The 10- to 40-inch control section is silty clay, clay, or silty clay loam. The soil in the control section is 35 to 60 percent clay, 0 to 10 percent limestone pebbles, and about 5 to 25 percent calcium carbonate equivalent.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, dark gray, very dark gray, brown, or dark brown. Thickness of the horizon that has moist value and chroma of less than 3.5 ranges from 14 to 36 inches. Reaction is moderately alkaline or mildly alkaline. Some pedons are noncalcareous in the upper 10 inches of the horizon.

The B horizon is brown, light brownish gray, grayish brown, pale brown, yellowish brown, light yellowish brown, light brown, or reddish brown. Concretions and powdery bodies range from less than 1 percent to about 10 percent by volume.

The C horizon is pale brown, light yellowish brown, brownish yellow, light brown, reddish yellow, or light reddish brown. It is silty clay loam, silty clay, or clay. Calcium carbonate segregations range from 2 to 20 percent by volume.

Lewisville Series

The Lewisville series consists of deep, well drained, clayey soils on uplands. These soils formed in clayey alluvium. Slope ranges from 1 to 5 percent.

Typical pedon of Lewisville silty clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Nolan River Road in Cleburne, 1.1 miles north on Nolan River Road, and 210 feet west of road in a field:

Ap—0 to 5 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure and moderate very fine granular; hard, friable; many fine roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

A1—5 to 14 inches; brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few fine pores; few concretions of calcium carbonate; few siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—14 to 28 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, firm; many concretions of calcium carbonate; few siliceous pebbles; few black concretions; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—28 to 60 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable; many fine concretions of calcium carbonate; few soft masses of calcium carbonate; few fragments of limestone from 1 inch to 4 inches across; calcareous; moderately alkaline.

The solum thickness ranges from 30 to about 70 inches. The horizons are clay loam, silty clay loam, or silty clay. Silicate clay content ranges from 24 to 35 percent. Calcium carbonate equivalent of the 10- to 40-inch control section ranges from 20 to 40 percent.

The A horizon is dark brown, brown, very dark grayish brown, dark grayish brown, or grayish brown. Thickness of the A horizon ranges from 7 to 20 inches.

The upper part of the B2ca horizon is brown, strong brown, dark grayish brown, olive brown, or dark yellowish brown through pinkish gray, light brownish gray, light brown, and light yellowish brown. Carbonates range from about 3 to 8 percent by volume and are in the form of concretions, masses, and threads.

The lower part of the B2ca horizon is about one unit of value higher than that of the upper part and has about 5 to 15 percent visible carbonates. The calcium carbonate equivalent of this horizon ranges from 25 to about 40 percent. In some places the horizon is underlain by beds of gravel at depths ranging from 3 to 15 feet.

Lindale Series

The Lindale series consists of moderately deep, well drained, loamy soils on uplands. These soils formed mainly in marine clays and limestone rubble. Slope ranges from 1 to 3 percent.

Typical pedon of Lindale clay loam, 1 to 3 percent slopes; from the intersection of Texas Highway 174 and Farm Road 917 in Joshua, 2.2 miles west on Farm Road 917, 6.4 miles north on Farm Road 1902, 0.3 mile east on County Road 920, and 75 feet south in idle field:

Ap—0 to 6 inches; brown (7.5YR 4/4) clay loam, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, firm; common fine roots; few wormcasts; few ironstone pebbles; neutral; clear smooth boundary.

B21—6 to 21 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine blocky structure; very hard, firm; few fine roots; patchy clay films on faces of peds; common ironstone pebbles; mildly alkaline; gradual smooth boundary.

B22t—21 to 30 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; few patchy clay films on faces of peds; estimated 5 percent, by volume, concretions of calcium carbonate; few soft masses of calcium carbonate in lower 3 inches; common ironstone pebbles; mildly alkaline; gradual smooth boundary.

B3ca—30 to 35 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; few fine faint reddish mottles; moderate medium blocky structure; very hard, very firm; many concretions of calcium carbonate; few soft masses of calcium carbonate; few black concretions; common fragments of limestone 1/2 inch to 6 inches in diameter; calcareous; moderately alkaline; clear wavy boundary.

Cca—35 to 60 inches; strong brown (7.5YR 5/6) very gravelly clay, strong brown (7.5YR 4/6) moist; massive; very hard, firm; about 70 percent, by volume, limestone gravel, cobbles, and stone; many concretions of calcium carbonate; few fragments of ironstone; calcareous; moderately alkaline.

The solum thickness and depth to the C horizon range from 20 to 40 inches. The C horizon has limestone gravel, cobbles, and stones. Depth to calcareous soil material ranges from 18 to 27 inches. Volume of fragments of ironstone in the solum ranges from few to 10 percent.

The A horizon is grayish brown, brown, or reddish brown. An A horizon that has moist value and chroma of less than 3.5 is less than 7 inches thick. Reaction ranges from slightly acid to moderately alkaline.

The B2t horizon is brown, yellowish red, reddish brown, light reddish brown, or red. It is clay or clay loam that is 35 to 50 percent clay. Reaction ranges from slightly acid to moderately alkaline.

The B3 horizon is yellowish brown, brown, strong brown, or reddish brown. Contrasting mottles of strong brown or reddish brown range from none to common. The B3 horizon is clay loam, clay, silty clay, or silty clay loam. Concretions of calcium carbonate and fragments of limestone range from few to 20 percent by volume.

The Cca horizon is yellowish brown, strong brown, brown, light brown, or reddish yellow. The fine earth fraction of the horizon is silty clay, clay, clay loam, or silty clay loam. The volume of fragments of limestone is 45 to 80 percent. This horizon is 35 to 50 percent gravel, 10 to 20 percent cobbles, and as much as 10 percent fragments of flat limestone 3 to 5 feet long, 2 to 3 feet wide, and 1 to 6 inches thick. Cobble and stone content is variable within short distances. Soft bodies of calcium carbonate are common to many.

Lott Series

The Lott series consists of deep, well drained, clayey soils on uplands. The soils formed in marly clays and clayey marl. Slope ranges from 1 to 3 percent.

Typical pedon of Lott silty clay, 1 to 3 percent slopes; from the intersection of Texas Highway 174 and Farm Road 917 in Joshua, 2.7 miles west on Farm Road 917, 1.8 miles north and west on County Road 911, and 1,300 feet south in field:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; slightly hard, friable; few fine roots; few concretions of calcium carbonate; few siliceous pebbles; few black concretions; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 26 inches; light yellowish brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few fine pores; common concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—26 to 46 inches; pale yellow (2.5Y 8/4) silty clay, pale yellow (2.5Y 7/4) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; many concretions and chalk fragments of calcium carbonate; calcareous; moderately alkaline, gradual smooth boundary.

C—46 to 62 inches; very pale brown (10YR 7/4) marly clay, light yellowish brown (10YR 6/4) moist; common fine distinct brownish yellow (10YR 6/8) mottles; massive; hard, firm; common soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 40 to 60 inches. Calcium carbonate equivalent of the 10- to 40-inch control section ranges from 45 to 80 percent. The soil is silty clay, clay, silty clay loam, or clay loam that is 35 to 50 percent clay and 25 to 35 percent silicate clay.

The A horizon is dark grayish brown or very dark grayish brown.

The B21 horizon is light yellowish brown, pale brown, brown, grayish brown, or pale yellow. The B22ca horizon is brown, pale brown, very pale brown, light yellowish brown, or pale yellow.

The C horizon ranges from marly clay or clayey marls to chalky marl. When the soil is dry, it is very hard and brittle.

Luckenbach Series

The Luckenbach series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in thick beds of calcareous, loamy and clayey sediments. Slope ranges from 1 to 3 percent.

Typical pedon of Luckenbach clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 6 miles west on U.S. Highway 67, 6.4 miles south on Park Road 21, 4.2 miles south on Farm Road 1434, and 144 feet east in pasture:

Ap—0 to 5 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, firm; few fine and medium roots; few wormcasts; few siliceous pebbles; mildly alkaline; abrupt smooth boundary.

A1—5 to 13 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few siliceous pebbles; mildly alkaline; clear smooth boundary.

B21t—13 to 30 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; few fine roots; nearly continuous clay films on faces of peds; few concretions of calcium carbonate; few siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

B22tca—30 to 48 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; weak coarse blocky structure; very hard, very firm; common concretions of calcium carbonate; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—48 to 62 inches, reddish yellow (7.5YR 6/6) clay loam, strong brown (7YR 5/6) moist; massive; hard, firm; many concretions, soft bodies, films, and threads of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 36 to 50 inches. Secondary carbonates in the form of concretions or soft bodies are at depths of 18 to 28 inches. The mollic epipedon ranges from 12 to 20 inches thick.

The A horizon is dark brown, brown, very dark grayish brown, dark grayish brown, or dark reddish gray. Reaction is slightly acid, neutral, or mildly alkaline.

The Bt horizon is dark reddish gray, reddish brown, or brown. The Bt horizon is clay or clay loam. This horizon is 35 to 55 percent clay. Siliceous or chert pebbles make up 0 to 15 percent by volume. Reaction is mildly alkaline or moderately alkaline.

The C horizon is brown, very pale brown, pale brown, pink, reddish yellow, or light brown. It is clay or clay loam. Soft bodies and concretions of calcium carbonate range from 5 to 15 percent by volume.

Medlin Series

The Medlin series consists of deep, well drained, clayey soils on uplands. These soils formed in alkaline marine sediment. Slope ranges from 5 to 15 percent.

Typical pedon of Medlin clay, 5 to 15 percent slopes; from the intersection of Highway 174 and Farm Road 917 in Joshua, 2.1 miles northeast on U.S. Highway 174, and 550 feet north in pasture:

A1—0 to 11 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few concretions of calcium carbonate; few ironstone pebbles; calcareous; moderately alkaline; gradual wavy boundary.

AC1—11 to 28 inches; olive (5Y 5/3) clay, olive (5Y 4/3) moist; strong medium blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common intersecting slickensides; common pockets of concretions of calcium carbonate; few ironstone pebbles; calcareous; moderately alkaline; gradual wavy boundary.

AC2—28 to 44 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common faint yellowish mottles; strong coarse blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; common intersecting slickensides; filled cracks of very dark grayish brown (2.5Y 3/2) material; few concretions of calcium carbonate; few black concretions; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 60 inches; mottled light olive brown and pale olive shaly clay.

The solum thickness ranges from 40 to more than 60 inches. Texture throughout is clay or silty clay that ranges from 40 to 60 percent clay. The soil is mildly alkaline or moderately alkaline and calcareous. When this soil is dry, cracks form and extend to a depth of more than 20 inches. These cracks remain open from 90 to 150 cumulative days in most years. Intersecting slickensides begin at a depth of 15 to 30 inches. Most untilled areas have gilgai relief of microvalleys ranging from 4 to 12 feet wide and from 3 to 8 inches deep and of microridges ranging from 6 to 20 feet wide that extend up and down the slope.

The A horizon is dark grayish brown, grayish brown, brown, olive brown, light olive brown, and olive. Where moist color values are less than 3.5, the horizon is less than 12 inches thick.

The AC horizon is grayish brown, pale brown, light yellowish brown, olive, light olive brown, very pale brown, or pale yellow. In places it has gray, yellowish brown, olive brown, olive yellow, or yellow mottles. Soft bodies and concretions of calcium carbonate range from 5 to 12 percent. Calcium carbonate equivalent in the lower part of the AC horizon ranges from 30 to 45 percent.

The C horizon is marly silty clay, shaly clay, or calcareous shale. It is grayish brown, brown, light olive brown, yellowish brown, pale yellow, pale olive, or yellow. In places it is mottled yellowish brown, gray, light olive brown, olive brown, or pale olive, olive, or olive yellow. Calcium carbonate equivalent ranges from 45 to more than 60 percent.

Minwells Series

The Minwells series consists of deep, well drained, loamy soils on terraces of the Brazos River. These soils formed in clayey and loamy sediments stratified with gravelly sandy clay loam and sand. Slope ranges from 1 to 5 percent.

Typical pedon of Minwells fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 4.8 miles west on U.S. Highway 67, 10.7 miles south on Farm Road 1434, 1.6 miles south on County Road 1108, 0.6 miles west on County Road 1242, 1.4 miles south on County Road 1117, and 84 feet north in pasture:

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; common fine roots; few rounded siliceous pebbles; slightly acid; abrupt smooth boundary.

B21t—7 to 14 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few fine pores; nearly continous clay films on faces of peds; common rounded siliceous pebbles; slightly acid; gradual smooth boundary.

B22t—14 to 30 inches; red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; few fine roots; patchy clay films on faces of peds; approximately 30 percent by volume of siliceous pebbles; slightly acid; gradual smooth boundary.

B23t—30 to 48 inches; red (2.5YR 5/8) sandy clay, red (2.5YR 4/8) moist; few faint yellowish and brownish mottles; weak medium blocky structure; very hard, very firm; few fine roots; many rounded siliceous pebbles; neutral; gradual smooth boundary.

B3—48 to 62 inches; yellowish red (5YR 5/8) gravelly sandy clay loam, yellowish red (5YR 4/8) moist; few faint yellowish mottles; weak fine subangular blocky structure; hard, firm; many rounded siliceous pebbles; mildly alkaline.

The solum thickness ranges from 40 to about 80 inches. Depth to beds of gravel ranges from 40 to about 70 inches.

The A horizon is light reddish brown, reddish brown, light brown, or brown. Siliceous pebbles range from 0 to 10 percent by volume. Reaction ranges from slightly acid to mildly alkaline.

The B21t and B22t horizons are red, yellowish red, or reddish brown. They are clay, clay loam, or sandy clay. These horizons are from 35 to 45 percent content of clay. Pebbles of chert and quartz range from 0 to 10 percent by volume. Reaction ranges from slightly acid to neutral.

The B23t and B3 horizons are red, yellowish red, or reddish brown. They are clay, clay loam, sandy clay loam, or gravelly sandy clay loam. Pebbles of quartz, chert, or limestone range from few to 20 percent by volume. Reaction ranges from neutral to moderately alkaline.

The C horizon is red, yellowish red, or reddish yellow. It is gravelly sandy clay loam, very gravelly sandy clay loam, very gravelly sandy loam, or very gravelly sand. Pebbles of quartz, chert, or limestone range from 25 to 80 percent by volume. Reaction ranges from mildly alkaline to moderately alkaline.

Navo Series

The Navo series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in alkaline, clayey sediment. Slope ranges from 0 to 5 percent.

Typical pedon of Navo clay loam, 2 to 5 percent slopes; from the intersection of U.S. Highway 67 and Farm Road 157 in Venus, 6 miles north on Farm Road 157, and 610 feet west in a field:

Ap—0 to 5 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky structure; very hard, firm, sticky and plastic; common fine and medium roots; few black concretions; slightly acid; clear smooth boundary.

B21t—5 to 15 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; common fine faint yellowish red (5YR 4/6) mottles; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; patchy clay films on faces of peds; few black concretions; slightly acid; gradual wavy boundary.

B22t—15 to 34 inches; yellowish brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; common medium prominent red (2.5YR 4/8), yellowish brown (10YR 5/8), and brownish yellow (10YR 6/8) mottles; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots on surfaces of peds; thin distinct clay films on faces of peds; few shiny pressure faces; common black concretions; medium acid; diffuse wavy boundary.

B23t—34 to 44 inches; prominently mottled yellowish brown (10YR 5/8), brownish yellow (10YR 6/8), light brownish gray (10YR 6/2), and grayish brown (10YR 5/2) clay; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; distinct clay films on faces of peds; few shiny pressure faces on peds; common black concretions; slightly acid; diffuse wavy boundary.

B3—44 to 62 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; few fine distinct yellowish brown (10YR 5/4), dark grayish brown (10YR 4/2), and grayish brown (10YR 5/2) mottles; weak coarse blocky structure; very hard, very firm, sticky and plastic; common concretions of calcium carbonate; few soft bodies of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The solum thickness ranges from 60 to 80 inches or more. Depth to soft powdery forms of calcium carbonate ranges from 30 to 80 inches.

The A horizon is grayish brown, dark grayish brown, or brown. It ranges from medium acid through neutral.

The B horizon is clay or clay loam; the soil ranges from 35 to 55 percent clay. Reaction in the upper part ranges from medium acid to neutral. The upper part of the horizon is yellowish red, reddish yellow, reddish brown, strong brown, brown, grayish brown, or yellowish brown, and has mottles of higher chroma. Mottles of reddish gray, weak red, yellowish red, red, reddish brown, light reddish brown, strong brown, yellowish brown, and brownish yellow are in most pedons. The lower part of the B horizon is reddish brown, reddish yellow, grayish brown, light brownish gray, brown, yellowish brown, brownish yellow, light yellowish brown, or yellow; the few to common mottles are red, brown, gray, or olive. Reaction ranges from slightly acid to moderately alkaline. The lower part of the horizon commonly is calcareous.

The C horizon, if present, is mottled red, brown, gray, and olive shaly clay and is below a depth of 60 inches.

Paluxy Series

The Paluxy series consists of deep, well drained, loamy soils on terraces of the Brazos River. These soils formed in loamy eolian or alluvial sediment. Slope ranges from 1 to 3 percent.

Typical pedon of Paluxy very fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, 4.8 miles west on U.S. Highway 67, 12 miles south on Farm Road 1434, 2.8 miles south on County Road 1117, 1.2 miles west on private road to gravel pit, and 178 feet east of road in field:

Ap—0 to 8 inches; brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine subangular blocky and granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.

B21—8 to 32 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common fine pores; few wormcasts; few pebbles of quartz; neutral; gradual smooth boundary.

B22—32 to 46 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure; slightly hard, friable; few fine pores; few pebbles of quartz; mildly alkaline; gradual smooth boundary.

C—46 to 62 inches, reddish yellow (5YR 6/6) very fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, friable; few films and threads of calcium carbonate; calcareous; moderately alkaline.

Depth to carbonates ranges form 36 to 80 inches. Texture is very fine sandy loam or loam throughout. Fine sand or coarser sand ranges from 15 to 35 percent.

The A horizon is brown, yellowish brown, reddish brown, light brown, pale brown, or light yellowish brown. Reaction is slightly acid or neutral.

The B horizon is reddish brown, yellowish red, or reddish yellow. Reaction is slightly acid, neutral, or mildly alkaline.

The C horizon is reddish yellow, yellowish red, strong brown, light reddish brown, or pink. Carbonates, where present, are films, threads, or soft bodies.

Ponder Series

The Ponder series consists of deep, moderately well drained, clayey soils on uplands. These soils formed in alkaline, clayey marine sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Ponder clay loam, 1 to 3 percent slopes; from the intersection of Texas Highway 171 and Farm Road 917 in Godley; 3.3 miles east on Farm Road 917, 2 miles north on County Road 1008, 1,300 feet east on County Road 912, and 600 feet north in field:

Ap—0 to 5 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; massive; extremely hard, very firm; common fine roots; few fine pores; few ironstone and siliceous pebbles; slightly acid; abrupt smooth boundary.

B21t—5 to 15 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; few patchy clay films on faces of peds; few black concretions; few filled cracks; neutral; gradual wavy boundary.

B22t—15 to 35 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; common fine prominent red (2.5YR 5/6) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; nearly continuous clay films on faces of peds; few black concretions; mildly alkaline; gradual wavy boundary.

B23t—35 to 40 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine prominent red (2.5YR 5/6) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots on faces of peds; nearly continuous clay films on faces of peds; few slickensides; common black concretions; moderately alkaline; clear smooth boundary.

B3ca—40 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak coarse blocky structure; hard, firm; few patches of clay films on faces of peds; common concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 60 to 80 inches or more. Depth to secondary carbonates ranges from 30 to 48 inches. Distance from the center of the microvalley to the center of the microhigh ranges from 6 to 15 feet.

The A horizon is dark brown, dark grayish brown, grayish brown, or brown. When the soil is dry, it is hard and massive. Reaction ranges from medium acid to neutral.

The B21t horizon is dark grayish brown, dark brown, brown, light olive brown, or reddish brown. It is clay, silty clay, silty clay loam, or clay loam. The B21t horizon is 35 to 50 percent clay. Reaction ranges from medium acid to neutral.

The B22t and B23t horizons are dark brown, dark grayish brown, grayish brown, brown, and light olive brown. Contrasting mottles of red, reddish brown, yellowish red, yellowish brown, or brown range from none to common. The B22t and B23t horizons are clay, silty clay, or silty clay loam. The content of clay ranges from 35 to 50 percent. Reaction ranges from slightly acid to moderately alkaline.

The B3ca horizon is in shades of brown, gray, or olive. It ranges from silty clay to loam. Concretions and soft masses of carbonates range from common to many.

Pulexas Series

The Pulexas series consists of deep, well drained, loamy soils on flood plains. These soils formed in loamy sediment that washed from noncalcareous soils in higher positions. Slope ranges from 0 to 1 percent.

Typical pedon of Pulexas fine sandy loam, frequently flooded; from the intersection of Interstate 35W and U.S. Highway 67, 4.2 miles north on Interstate 35W, 2.7 miles east on Farm Road 917, 1.1 miles north on County Road 604, and 81 feet east in rangeland:

A—0 to 12 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; slightly hard, very friable; many fine and few medium roots; few fine pores; few wormcasts; neutral; clear smooth boundary.

C1—12 to 32 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; few fine roots; few thin darker strata that have distinct bedding planes; mildly alkaline; gradual smooth boundary.

C2—32 to 39 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable; few fine roots; mildly alkaline; clear smooth boundary.

C3—39 to 56 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; few fine roots; few faint bedding planes; mildly alkaline; clear smooth boundary.

C4—56 to 65 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; few faint brownish mottles; massive; slightly hard, friable; mildly alkaline.

The 10- to 40-inch control section is fine sandy loam that is stratified with thin lenses of one or more textures ranging from loamy sand to clay loam. Stratification varies from scarcely evident to prominent. The soil in the control section ranges from 8 to 18 percent clay. Reaction ranges from medium acid to moderately alkaline. In some pedons the soil has calcareous strata in the lower part.

The A horizon is grayish brown, light brownish gray, brown, pale brown, yellowish brown, or light yellowish brown. Some pedons have thin Ap or A1 horizons of light brown. Where moist value and chroma are less than 3.5, the horizon is less than 10 inches thick.

The C horizon is grayish brown, light brownish gray, brown, yellowish brown, light yellowish brown, or pale brown. In some pedons this horizon has thin strata of light brown and has few pale brown or brown mottles in the lower part. In some pedons dark buried horizons are below a depth of 30 inches. The C horizon is dominantly fine sandy loam, sandy loam, or loam stratified with thin lenses of loamy fine sand, sandy clay loam, or clay loam.

Pursley Series

The Pursley series consists of deep, well drained, loamy soils on flood plains. These soils formed in loamy, calcareous sediment from calcareous soils in higher positions. Slope ranges from 0 to 1 percent.

Typical pedon of Pursley clay loam, frequently flooded; from the intersection of Texas Highway 174 and Farm Road 731 in Burleson, 0.7 mile south on Texas Highway 174, 1.4 miles northwest on County Road 920, and 410 feet south in rangeland:

A1—0 to 18 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular and subangular blocky structure; hard, friable; many fine and few medium fine roots; common very fine pores; common wormcasts; calcareous; moderately alkaline; clear smooth boundary.

C1—18 to 36 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; common fine roots; few fine pores; few concretions of calcium carbonate; few very pale brown loam bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—36 to 48 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; few grayish brown layers associated with bedding planes; few fine roots; common concretions of calcium carbonate; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C3—48 to 60 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable; few faint yellowish mottles; common concretions of calcium carbonate; calcareous; moderately alkaline.

The organic matter content decreases irregularly with depth, or it is more than 0.3 percent at a depth of 50 inches. Bedding planes are visible at a depth of 40 inches. The soil is mildly alkaline or moderately alkaline and calcareous.

The A horizons are dark brown, brown, dark grayish brown, or grayish brown. The mollic epipedon is 10 to 20 inches thick.

The C horizon is grayish brown, brown, yellowish brown, pale brown, light brownish gray, very pale brown, olive gray, light olive gray, or pale yellow. Chroma of 2 is assumed to be inherited from the high lime content. The C horizon is loam or clay loam. In some pedons the B horizon, if present, is as much as 20 inches thick and has colors and textures similar to those of the C horizon. The 10- to 40-inch control section ranges from 18 to 35 percent clay and is more than 15 percent material coarser than very fine sand.

The C horizon is stratified with sandy and clayey textures but averages loam or clay loam. In some pedons the buried darker clay is below a depth of 40 inches.

Purves Series

The Purves series consists of shallow, well drained, clayey soils on uplands. These soils formed over interbedded limestone and calcareous marl. Slope ranges from 1 to 5 percent.

Typical pedon of Purves clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 174 in Cleburne, about 7.4 miles west on U.S. Highway 67, 4.4 miles north on Farm Road 2331, and 1,320 feet northeast in rangeland:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky and granular structure; very hard, firm; many fine roots; common concretions of calcium carbonate; few fragments of limestone 0.1 inch to 2 inches across the long axis; calcareous; moderately alkaline; gradual smooth boundary.

A12ca—7 to 14 inches; dark grayish brown (10YR 4/2) very gravelly clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky structure; very hard, firm; many fine roots; many calcium carbonate concretions; approximately 55 percent, by volume, fragments of limestone 1 inch to 4 inches across the long axis; calcareous; moderately alkaline; abrupt smooth boundary.

R—14 to 16 inches; indurated fractured limestone.

The solum thickness ranges from 8 to 20 inches. Fragments of limestone that are 0.1 inch to 10 inches across the long axis range from none to about 35 percent by volume. Secondary carbonates are concretions, soft bodies, and coatings and pendants on fragments. The fine earth is clay, clay loam, silty clay loam, and silty clay. It ranges from 35 to 55 percent clay.

The A horizon is dark grayish brown, very dark grayish brown, very dark gray, dark gray, grayish brown, or brown.

Rader Series

The Rader series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in slightly acid to alkaline, clayey sediment interbedded with loamy material. Slope ranges from 0 to 3 percent.

Typical pedon of Rader fine sandy loam, 0 to 3 percent slopes; from the intersection of Texas Highway 174 and Farm Road 917 in Joshua, 4.1 miles east on Farm Road 917, 1.3 miles north on County Road 805, 0.6 mile north of County Road 806 on 805, and 64 feet east in pasture:

A1—0 to 4 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine granular structure; hard, very friable; many fine roots; slightly acid; gradual smooth boudary.

A21—4 to 10 inches; light yellowish brown (10YR 6/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular parting to weak fine subangular blocky structure; hard, very friable; many fine roots; common reddish stains; slightly acid; gradual smooth boundary.

A22—10 to 16 inches; pale brown (10YR 6/3) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak moderate subangular blocky structure; hard, friable; common fine roots; few fine pores; few yellowish stains; slightly acid; clear wavy boundary.

B&A—16 to 27 inches; discrete bodies of light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist, the majority of which are coated with light gray (10YR 7/2) fine sandy loam; few fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; hard, firm; few fine roots; many fine and medium pores; few black concretions; few ironstone pebbles; medium acid; clear wavy boundary.

B21t—27 to 38 inches; light gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; few fine distinct brownish yellow (10YR 6/8) and red (2.5YR 4/8) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; few light gray (10YR 7/2) fine sandy loam coatings on faces of peds; few patchy clay films on faces of peds; common black concretions; strongly acid; gradual smooth boundary.

B22t—38 to 53 inches; coarsely and prominently mottled light gray (10YR 7/1), brownish yellow (10YR 6/6), and dark red (2.5YR 3/6) clay; moderate medium blocky structure; extremely hard, very firm; few fine roots; common black concretions; medium acid; gradual smooth boundary.

B23t—53 to 64 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) moist; coarse medium and prominent brownish yellow (10YR 6/8) and yellowish red (5YR 4/6) mottles; weak coarse blocky structure; very hard, firm; common black concretions; slightly acid; gradual smooth boundary.

B3—64 to 72 inches; yellow (10YR 7/8) sandy clay loam, brownish yellow (10YR 6/8) moist; coarse medium and distinct light gray (10YR 7/1) mottles; weak coarse blocky structure; very hard, firm; many black concretions; slightly acid.

The solum thickness ranges from 60 to 100 inches or more. Content of clay in the control section is 28 to 35 percent.

The A horizon is very strongly acid to slightly acid. The A1 horizon is light brownish gray, grayish brown, brown, pale brown, and very pale brown. The A2 horizon is light gray, light yellowish brown, pale brown, very pale brown, and light brownish gray.

The B&A horizon is very strongly acid through medium acid. About 70 to 85 percent, by volume, consists of B material that is sandy clay loam, clay loam, or loam. This material is light yellowish brown, yellowish brown, brownish yellow, strong brown, and pale brown. Few to common mottles in shades of brown, red, and gray are present. The A material of this horizon is light gray, white, light brownish gray, and very pale brown. It is fine sandy loam or loam and occurs as coatings and pockets intermingled with the B material.

The B21t and B22t horizons are light brownish gray, grayish brown, light gray, brown, and yellowish brown. They have common to many mottles of these colors and, in addition, red, yellowish red, strong brown, yellowish brown, and olive yellow. The B21t and B22t horizons are mainly sandy clay but range to clay or clay loam. These horizons are 35 to 50 percent clay and average about 40 percent. Reaction is very strongly acid to medium acid. Coatings of A2 material from the overlying layer are few to common on prism faces in the upper part of the B21t horizon.

The B23t and B3 horizons are mottled in shades of gray, yellow, and brown. They are sandy clay loam but range to sandy clay or clay. These horizons are strongly acid through moderately alkaline. Pressure faces ranging from 1 inch to 3 inches across are few to common in the B2t horizon. In places the B3 horizon has a few soft masses and concretions of calcium carbonate.

The Rader soils mapped in Johnson County are taxadjuncts to the Rader series because the lower Bt horizons and the B3 horizon are more alkaline than is typical for the series. However, use and behavior are similar to those of soils of the Rader series.

Rayex Series

The Rayex series consists of shallow, well drained, loamy soils on uplands. These soils formed in stratified shale and sandstone that are high in iron content. Slope ranges from 5 to 20 percent.

Typical pedon of Rayex stony fine sandy loam, in an area of Birome-Rayex complex, 5 to 20 percent slopes; from the intersection of Texas Highway 174 and Farm Road 917 in Joshua, 2.9 miles west on Farm Road 917, 0.3 mile south on County Road 1017, 0.2 mile south on Benjamin Boulevard, 0.1 mile east on Mountainview Road, and 492 feet northeast in rangeland:

A—0 to 4 inches; brown (10YR 4/3) stony fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; slightly hard, very friable; few medium roots; many thin fragments of sandstone 0.1 inch to 15 inches across the long axis; neutral; clear smooth boundary.

B2t—4 to 15 inches; red (2.5YR 4/8) clay, red (2.5YR 4/8) moist; strong medium blocky structure; very hard, very firm, plastic; few medium roots; continuous clay films on faces of peds; common fragments of sandstone 1 inch to 5 inches across the long axis; strongly acid; gradual irregular boundary.

Cr—15 to 40 inches; weakly cemented sandstone interbedded with red (2.5YR 4/8) clay; layers of sandstone are 1/2 inch to 2 inches thick; clay strata are 1 inch to 6 inches thick; strongly acid.

The solum thickness and the depth to fractured sandstone range from 10 to 20 inches.

The A horizon is brown, dark brown, light brown, grayish brown, and very pale brown. It is stony fine sandy loam or gravelly fine sandy loam. Fragments of sandstone or ironstone that range from 2 inches to 4 feet in diameter make up 2 to 20 percent by volume of the A horizon. Reaction ranges from medium acid to neutral. In some pedons the A2 horizon is 2 to 4 inches thick, and colors are 1 to 2 units of value higher than those of the A1 horizon.

The B2t horizon is yellowish red, red, reddish brown, light red, reddish yellow, and strong brown. It is clay loam, sandy clay, or clay; the soil ranges from 35 to 55 percent clay. Reaction ranges from medium acid to very strongly acid. Fragments of angular and subrounded ironstone and sandstone range from 2 to 15 percent.

The Cr horizon is fractured, reddish, weakly cemented sandstone interbedded with red, brown, and gray shale and clay. The sandstone has a hardness of less than 3 on Mohs' scale and can be cut with a spade. Reaction ranges from strongly acid through slightly acid. Shale and clay strata increase in thickness as depth increases.

Sanger Series

The Sanger series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous, clayey marine sediment. Slope ranges from 1 to 5 percent.

Typical pedon of Sanger clay, 1 to 3 percent slopes; from the intersection of Texas Highway 174 and Farm Road 1192 in Cleburne, 12.3 miles west on Farm Road 1192, 1.5 miles north on County Road 1232, and 170 feet west in rangeland:

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium granular and subangular blocky structure; extremely hard, very firm, sticky and plastic; many fine roots; few fine concretions of calcium carbonate; few wormcasts; calcareous; moderately alkaline; clear smooth boundary.

A12—8 to 37 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; few intersecting slickensides; common fine concretions of calcium carbonate; few siliceous pebbles; few cracks filled with very dark grayish brown (10YR 3/2) material; calcareous; moderately alkaline; gradual wavy boundary.

AC1—37 to 60 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; few fine faint yellowish mottles; weak coarse blocky structure; hard, firm, sticky and plastic; few fine roots; common intersecting slickensides; many concretions of calcium carbonate; few limestone pebbles; few fragments of shell; cracks filled with very dark grayish brown (10YR 3/2) material; calcareous; moderately alkaline; gradual wavy boundary.

AC2—60 to 72 inches; light yellowish brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; common fine faint olive brown (2.5Y 4/4) mottles; weak coarse blocky structure; hard, firm, sticky and plastic; many concretions of calcium carbonate; few soft bodies of calcium carbonate; few fragments of shell; few black concretions; calcareous; moderately alkaline; diffuse boundary.

C—72 to 80 inches; yellow (10YR 7/6) shaly clay, brownish yellow (10YR 6/6) moist; common fine faint yellowish brown (10YR 5/6) mottles; massive; extremely hard, very firm; many soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 40 to more than 70 inches. When the soil is dry, cracks as much as 1 inch wide extend to a depth of 20 inches or more. Intersecting slickensides begin at depths of 16 to 24 inches. Most untilled areas have a microrelief of microvalleys 4 to 12 feet wide and 3 to 12 inches deep and microridges 6 to 20 feet wide that extend up and down the slope. The control section is silty clay or clay.

The A horizon is very dark grayish brown, dark grayish brown, or grayish brown. It is dominantly calcareous, but ranges to mildly alkaline and noncalcareous in the upper 12 inches in the microdepressions of some pedons.

The AC1 horizon is grayish brown, brown, light brownish gray, light yellowish brown, light olive brown, or very pale brown. Mottles of brownish yellow, olive yellow, or yellow range from none to few.

The AC2 horizon is grayish brown, pale brown, light brownish gray, yellowish brown, light yellowish brown, olive yellow, or very pale brown. Mottles of gray, light gray, yellowish brown, brownish yellow, olive brown, or light olive brown range from few to common. Concretions and soft bodies of calcium carbonate range from 3 to 10 percent throughout. The calcium carbonate equivalent of the AC horizon ranges from 40 to 60 percent in more than half the pedon.

The C horizon is mottled in shades of brown, gray, and yellow. It is clay, silty clay, or shaly clay, and in places has remnants of limestone.

Seawillow Series

The Seawillow series consists of deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy alluvium. Slope ranges from 1 to 12 percent.

Typical pedon of Seawillow clay loam, 1 to 5 percent slopes; from the intersection of Texas Highway 174 and U.S. Highway 67 in Cleburne, 6 miles west on U.S. Highway 67, 7.3 miles south on Park Road 21 and Farm Road 1434, 3.9 miles west on Farm Road 200, 0.1 mile north on County Road 1237, and 590 feet southwest in rangeland:

A1—0 to 8 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; hard, friable; many fine roots; common fine pores; common wormcasts; few concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bca—8 to 24 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate fine subangular blocky and granular structure; hard, friable; few fine roots; few wormcasts; many concretions of calcium carbonate; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—24 to 60 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; hard, friable; few fine roots; common fine pores; few concretions and soft masses of calcium carbonate; many films and threads of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 18 to 40 inches. The soil, including the C horizon, is loam, clay loam, or silty clay loam and is 40 to 70 percent calcium carbonate equivalent. Coarse fragments of limestone pebbles or siliceous pebbles make up 0 to 15 percent by volume of the solum. Silicate clay is 20 to 30 percent. Carbonate clay is 2 to 10 percent.

The A horizon is yellowish brown, brown, or grayish brown.

The B and C horizons are brown, yellowish brown, light yellowish brown, brownish yellow, pale brown, or very pale brown. Concretions of calcium carbonate make up 0 to 10 percent of the C horizon.

Silstid series

The Silstid series consist of deep, well drained, sandy soils on uplands. These soils formed in beds of sandy or loamy material and interbedded sandstone. Slope ranges from 1 to 8 percent.

Typical pedon of Silstid loamy fine sand, 1 to 3 percent slopes; from the intersection of Interstate 35W and U.S. Highway 67, 4.6 miles south on Interstate 35W, 0.2 mile west into sandpit, and 300 feet south of fence in rangeland:

A1—0 to 14 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose;

common fine and medium roots; few coarse roots; neutral; clear smooth boundary.

A2—14 to 26 inches; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose; common fine roots; few medium roots; neutral; clear smooth boundary.

B21t—26 to 39 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; few fine faint reddish mottles; moderate fine and medium subangular blocky structure; very hard, friable; few fine and medium roots; many fine pores; few patchy clay films on faces of peds; few black concretions; common wormcasts; slightly acid; clear smooth boundary.

B22t—39 to 57 inches; yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) moist; few medium distinct mottles of yellowish red (5YR 5/8); moderate medium subangular blocky structure; very hard, friable; few fine roots; common fine pores; few patchy clay films on faces of peds; few wormcasts; few root channels; slightly acid; gradual wavy boundary.

B23t—57 to 80 inches; coarsely and prominently mottled very pale brown (10YR 7/3), brownish yellow (10YR 6/8), and red (2.5YR 4/8) sandy clay loam; moderate fine subangular blocky structure; hard, friable; few fine roots; common fine pores; few wormcasts; slightly acid.

The solum thickness ranges from 60 to 80 inches or more.

The A horizon is 20 to 40 inches thick. Reaction is medium acid through neutral. The A1 horizon is pale brown, very pale brown, grayish brown, brown, yellowish brown, dark brown, light yellowish brown, dark yellowish brown, or light brown. The A2 horizon is very pale brown, light brown, pale brown, or light yellowish brown.

The Bt horizon is brownish yellow, yellow, reddish yellow, yellowish red, yellowish brown, very pale brown, or strong brown. Reddish mottles that have chroma of 6 or 8 are throughout the Bt horizon. The Bt horizon is sandy clay loam, loam, or fine sandy loam. The clay content of this horizon is 18 to 35 percent. Reaction is medium acid or slightly acid.

In some pedons a C horizon is below a depth of 60 inches. It is loamy fine sand, fine sandy loam, sandy clay loam, or weakly cemented sandstone. Reaction ranges from strongly acid through slightly acid.

Slidell Series

The Slidell series consists of deep, well drained, clayey soils on uplands. These soils formed in calcareous, clayey marine sediment. Slope ranges from 0 to 3 percent.

Typical pedon of Slidell clay, 1 to 3 percent slopes; from the intersection of Farm Road 2435 and Texas Highway 171 in Godley, 3.1 miles northwest on Texas Highway 171, and 58 feet south in rangeland:

Ap—0 to 6 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; many fine roots; few clay films on ped faces; few concretions of calcium carbonate; few siliceous pebbles; few wormcasts; calcareous; moderately alkaline; abrupt smooth boundary.

A11—6 to 20 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few intersecting slickensides in lower part; common concretions of calcium carbonate; few siliceous pebbles; few cracks filled with black (10YR 2/1) material; calcareous; moderately alkaline; gradual wavy boundary.

A12—20 to 45 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common intersecting slickensides; common concretions of calcium carbonate; few black concretions; few fragments of shell; few cracks filled with black (10YR 2/1) material; calcareous; moderately alkaline; gradual wavy boundary.

AC1—45 to 60 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; few fine faint yellowish and brownish mottles; weak coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots along faces of peds; many intersecting slickensides; common concretions of calcium carbonate; few cracks filled with very dark gray (10YR 3/1) material; calcareous; moderately alkaline; clear wavy boundary.

AC2—60 to 72 inches; light brownish gray (2.5YR 6/2) clay, grayish brown (2.5Y 5/2) moist; common medium distinct yellow (2.5Y 7/6), yellowish brown (10YR 5/8), and very dark grayish brown (10YR 3/2) mottles; weak coarse blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; many concretions of calcium carbonate; few soft bodies of calcium carbonate; few cracks filled with very dark grayish brown (10YR 3/2) material; calcareous; moderately alkaline; diffuse boundary.

C—72 to 80 inches; light brownish gray (2.5Y 6/2) marly clay, grayish brown (2.5Y 5/2) moist; common fine distinct brownish yellow (10YR 6/8) and grayish brown (10YR 5/2) mottles; massive; hard, firm; many soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum thickness ranges from 60 to 80 inches or more. When the soil is dry, cracks as much as 1 inch wide extend to depths of more than 20 inches. Intersecting slickensides are at depths ranging from 16 to 25 inches. In more than half of each pedon, the calcium carbonate equivalent ranges from 40 to 60 percent in the 10- to 40-inch control section. Texture throughout is silty clay or clay. The thickness of the A horizon and the depth to any subhorizon that has matrix colors of chroma more than 1.5 range from 20 to 50 inches in more than 60 percent of any pedon. In less than 40 percent of the pedon, chroma of 2 or more is within a depth ranging from 8 to 20 inches. Cycles of microdepressions and microknolls are repeated each 10 to 20 feet.

The A horizon is dark gray or very dark gray. It is dominantly calcareous, but in places it is noncalcareous in the center of microdepressions.

The AC1 horizon is dark grayish brown, grayish brown, brown, or light yellowish brown. Mottles of light brown, brown, yellowish brown, dark yellowish brown, or brownish yellow range from none to common.

The AC2 horizon is grayish brown, brown, light yellowish brown, very pale brown, pale yellow, or light brownish gray. Mottles of dark grayish brown, yellowish brown, grayish brown, very dark grayish brown, brownish yellow, or yellow range from few to common. Soft bodies and concretions of calcium carbonate range from 2 to 5 percent throughout the AC horizons and are more common in microknolls.

The C horizon is pale brown or light brownish gray and is mottled olive brown, gray, brownish yellow, olive yellow, or yellow. In some pedons fractured limestone interbedded with marly silty clay or silty clay loam is below a depth of 70 inches.

Sunev Series

The Sunev series consists of deep, well drained, loamy soils on uplands. These soils formed in ancient, loamy alluvium and colluvium. Slope ranges from 1 to 5 percent.

Typical pedon of Sunev clay loam, 3 to 5 percent slopes; from the intersection of Texas Highway 174 and Farm Road 1192 in Cleburne, 13.1 miles west on Farm Road 1192, 1.7 miles west on County Road 1131A, and 207 feet south in rangeland:

A—0 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; many fine roots; many wormcasts and holes; common concretions of calcium carbonate; few films and threads of calcium carbonate; few fragments of shell; calcium carbonate equivalent of about 34 percent; calcareous; moderately alkaline; clear smooth boundary.

B2ca—12 to 23 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong very fine granular structure; hard, friable; few fine roots; many wormcasts and holes; many concretions of calcium carbonate; few films and threads of calcium carbonate; few fragments of shell; calcium carbonate equivalent of about 44 percent; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—23 to 44 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; strong very fine granular structure; slightly hard, very friable; few fine roots; few wormcasts and holes; many concretions, soft masses, films, and threads of calcium carbonate; calcium carbonate equivalent is about 52 percent; calcareous; moderately alkaline; diffuse boundary.

Cca—44 to 62 inches; pale yellow (2.5Y 7/4) clay loam, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, very friable; many concretions, soft masses, films, and threads of calcium carbonate; calcium carbonate equivalent is about 60 percent; calcareous; moderately alkaline.

The solum thickness ranges from 40 to 70 inches. Calcium carbonate equivalent in the 10- to 40-inch control section ranges from 40 to 70 percent. The content of limestone pebbles ranges from 0 to 15 percent.

The A horizon is dark grayish brown, very dark grayish brown, dark brown, grayish brown, or brown.

The B horizon is brown, pale brown, grayish brown, very pale brown, dark yellowish brown, yellowish brown, strong brown, light brown, pink, reddish yellow, or light yellowish brown. In some pedons this horizon has few to common brownish and yellowish mottles. The B horizon is clay loam, loam, or silty clay loam.

The C horizon is very pale brown, pale yellow, or reddish yellow. It is clay loam, loam, or silty clay loam. Below a depth of 6 feet the material is clay loam, loam, gravelly loam, or gravel.

Tinn Series

The Tinn series consists of deep, somewhat poorly drained, clayey soils on bottom lands. These soils formed in calcareous, clayey alluvium. Slope ranges from 0 to 1 percent.

Typical pedon of Tinn clay, frequently flooded; from the intersection of Farm Road 1706 and Farm Road 1807 in Alvarado, 2.3 miles southeast on Farm Road 1807, 3.3 miles south on County Road 206; 0.9 mile east on County Road 107, and 142 feet north in pasture:

A11—0 to 18 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium granular and weak fine subangular blocky structure; very hard, very firm, very sticky; many fine and very fine roots; many wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

A12—18 to 42 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium subangular blocky and blocky structure; very hard, very firm, very sticky; common fine and very fine roots; common wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

C—42 to 60 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; few fine olive to yellowish brown mottles; massive; very hard, very firm, very sticky; calcareous; moderately alkaline.

Reaction of the solum ranges from mildly alkaline to moderately alkaline.

The A horizon ranges from dark gray to black. Mottles of olive and brown in the 10- to 40-inch control section range from none to common. The control section is clay or silty clay. The clay content in the A horizon ranges from 40 to 60 percent.

The C horizon ranges from very dark gray to olive gray and has olive, yellowish brown, or olive yellow mottles. Strongly cemented concretions of calcium carbonate range from none to many. In some pedons this horizon has gravel and sand at a depth of 40 inches or more.

Wilson Series

The Wilson series consists of deep, somewhat poorly drained, loamy soils on uplands. These soils formed in nearly impervious marine clay. Slope ranges from 0 to 3 percent.

Typical pedon of Wilson silty clay loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 110 in Grandview, 2.2 miles north on U.S. Highway 81, 5 miles northeast on Farm Road 2258, 1.9 miles south on County Road 206, 0.4 mile east on County Road 104, 0.2 mile south on county road, and 342 feet west in pasture:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure, massive when dry; very hard; common fine roots; slightly acid; abrupt wavy boundary.

B21tg—7 to 32 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; few faint reddish mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; few fine pores; continous clay films on faces of peds; lighter Ap material coats some peds and fills vertical cracks; neutral; gradual smooth boundary.

B22tg—32 to 50 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; few faint brownish mottles; moderate medium blocky structure; extremely hard, very firm; continous clay films on faces of peds; few shiny pressure faces; few cracks filled with lighter colored material; few concretions of calcium carbonate in lower part; neutral; gradual wavy boundary.

B3g—50 to 66 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; few fine faint yellowish mottles; weak coarse blocky structure; extremely hard, very firm; few patchy clay films on faces of peds; common concretions of calcium carbonate; few siliceous pebbles; few black concretions; mildly alkaline; gradual smooth boundary.

C—66 to 72 inches; distinctly mottled light brownish gray (2.5Y 6/2), grayish brown (10YR 5/2), and yellowish brown (10YR 5/6) silty clay; massive; extremely hard, very firm; common concretions of calcium carbonate; few soft masses of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The solum thickness ranges from 40 to 60 inches or more. Cracks 0.4 to 0.8 inch or more wide extend from the top of the Bt horizon to a depth of 24 inches or more.

The A horizon is less than 10 inches thick in more than 50 percent of the profile, but it is as much as 15 inches thick in subsoil troughs. It has moist colors of very dark gray, dark gray, very dark grayish brown, dark grayish brown, grayish brown, gray, or black. The A horizon is massive and hard to very hard when dry, but it has weak structure when moist. In some pedons a light gray A2 horizon less than 1 inch thick overlies the deeper B horizon waves, but this horizon is not present on the B horizon crests. The A and B21tg horizons range from medium acid through mildly alkaline.

The B21tg horizon has moist colors of very dark gray, dark gray, or black. In some pedons few to common fine and medium brownish or yellowish mottles are present. The B21tg horizon is silty clay, clay, silty clay loam, or clay loam and is 35 to 50 percent clay.

The B22tg and B3g horizons have moist colors of dark gray, gray, grayish brown, dark grayish brown, light brownish gray, olive gray, or light olive gray. In some pedons mottles are olive, brown, or yellow. In most pedons crystals of gypsum and calcium carbonate concretions are present. The B3g and C horizons range from neutral through moderately alkaline.

The C horizon has moist colors of gray, light brownish gray, pale brown, light yellowish brown, grayish brown, dark grayish brown, olive gray, light olive gray, light olive brown, yellowish brown, very pale brown, reddish yellow, yellowish red, or brown silty clay or clay.

Yahola Series

The Yahola series consists of deep, well drained, loamy soils on bottom lands along the Brazos River. These soils formed in loamy, calcareous alluvium. Slope ranges from 0 to 2 percent.

Typical pedon of Yahola fine sandy loam in an area of Yahola-Gaddy complex, occasionally flooded; from the intersection of U.S. Highway 67, and Texas Highway 174 in Cleburne, 6 miles west on U.S. Highway 67, 11.8 miles south on Park Road 21 and Farm Road 1434, 3.6 miles south on County Road 1240, 1 mile south on County Road 1241, 0.2 mile west on private lane to house, and 1,590 feet south in pasture:

A—0 to 17 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; many fine roots; about 5 inches of dark brown (7.5YR 4/4) silty clay loam overwash material; few wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

C1—17 to 28 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; common fine roots; few thin strata of reddish brown (5YR 4/4) silty clay loam; few wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

C2—28 to 38 inches; reddish yellow (7.5YR 6/6) loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; common fine roots; calcareous; moderately alkaline; gradual smooth boundary.

C3—38 to 60 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few fine roots; thin strata of dark brown (7.5YR 4/4) fine sandy loam in the upper part and reddish yellow (7.5YR 6/6) fine sandy loam in lower part; few films and threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon is brown, pinkish gray, light brown, pink, strong brown, reddish yellow, dark reddish gray, reddish gray, pinkish gray, reddish brown, light reddish brown, yellowish red, weak red, red, or light red. The horizon is fine sandy loam, loam, or loamy fine sand. If it is loamy fine sand, the horizon is less than 12 inches thick. The soil is mildly alkaline or moderately alkaline in the upper 10 inches and moderately alkaline and calcareous in the lower part.

The C horizon is light brown, reddish yellow, brown, strong brown, reddish brown, light reddish brown, pink, yellowish red, red, or light red. The horizon is fine sandy loam or loam and has 5 to 18 percent clay content above a depth of 40 inches. Below a depth of 40 inches, it is fine sandy loam, loam, or loamy fine sand. Thin strata of coarser or finer material occur throughout the C horizon.

Formation of the Soils

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given place are determined by (1) the physical and mineral composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the material. All five factors influence the present characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor may dominate soil formation; in another area a different factor may be important.

The interrelationships of these factors are complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient, however, to discuss each factor separately and to indicate the probable effects of each.

Parent Material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limit of the chemical and mineral composition of the soil. The soils of Johnson County have developed from parent material that was deposited by or in water.

Most of the soils in Johnson County formed from parent material deposited during the Cretaceous geological period. This parent material included beds of limestone from which Aledo, Bolar, Hensley, Lindale, and Purves soils developed; weakly cemented acid sandstone and packsand from which Birome and Rayex soils developed; and calcareous marl, clay, and shale from which Heiden, Houston Black, Sanger, and Slidell soils developed.

Other soils formed from parent material deposited during the Quaternary geological period. The Pleistocene and recent ages are subdivisions of the Quaternary Period. Parent material deposited during the Pleistocene age is on ancient stream terraces above present day flood plains. This parent material includes sandy sediment from which Decordova soils developed; loamy sediment from which Bastrop and Paluxy soils developed; and clayey and loamy sediments from which Callisburg, Luckenbach, and Minwells soils developed. Parent material of recent ages is on flood plains of streams. It includes loamy sediment from which such soils as Gowen, Pulexas, Pursley, and Yahola soils developed; calcareous clayey sediment from which Frio and Tinn soils developed; and sandy sediment from which Gaddy soils developed.

Climate

The climate contributes to the formation of soils in several ways. The high temperatures, periods of high humidity, and adequate rainfall have encouraged deep penetration of water into the earth's crust. The moisture and warm temperatures favor deep penetration of plant roots, the development of micro-organisms, and chemical weathering. As a result, many deep soils have formed in the county. The removal of calcium and other chemicals from some of the soils by leaching has resulted in the formation of some soils that are low in some kinds of essential plant nutrients.

Patterns of rainfall distribution cause the soils to be alternately wet and dry. When clay soils, such as Burleson, Heiden, and Sanger soils, become dry, they crack and the rainfall washes some of the surface layer into the cracks. However, if wetting continues, the cracks swell shut. This alternate shrinking and swelling causes churning and heaving of the soils and prevents formation of clay accumulations. Other soils, such as Crosstell, Navo, and Wilson soils, have clayey lower layers. Water moving through the soil detaches clay particles from the surface layer and deposits these particles in the lower layers when the water movement slows. As clay accumulates, the water moves more slowly and the deposition of clay accelerates. Thus, the accumulative process tends to speed up, and the lower layers become more clayey.

Wind also affects the formation of the soils. The sandy and loamy soil material in which the Coving, Decordova, and Silstid soils formed has been reworked by wind.

Plant and Animal Life

Vegetation, animals, micro-organisms, earthworms, and other organisms that live on and in the soil contribute to its development. More recently, man also has contributed to the development of the soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are caused by living organisms. In the nearly treeless prairies of Johnson County, tall grasses had more influence on soil development than other plants. These grasses provided litter that protected the surface and added organic matter to darken the soils. The Bolar, Krum, Sanger, and Slidell soils are examples. The grass roots reached deep into the soils and used minerals at a lower depth. Lime, other minerals, and organic matter were distributed throughout the soil profile as these plants died and decomposed. The decomposed plant roots left channels that increase the intake of water and aeration of the soil. Earthworms and other soil organisms fed on the decomposed roots. The borings of earthworms also helped channel water and air through the soils.

In parts of the county where the native vegetation is mostly oak savannah, organic matter has mainly accumulated in the top few inches of the soil. This organic matter is quickly destroyed if the soil is cultivated. These soils have a light colored surface layer and are acid in the upper part of the subsoil. The Crosstell, Gasil, and Silstid soils are examples. Burrowing animals, such as crayfish, gophers, and moles, helped mix the soil and parent material.

Man and his methods of tillage and grazing animals have also influenced soil formation. Most of the savannahs and the prairies have been cleared for crops. Cultivation has encouraged runoff and erosion and reduced the content of organic matter. Tillage and continuous overgrazing have compacted the clayey soils and reduced aeration, infiltration, and permeability. All of these changes are reflected in the present productivity of the soil and will have some effect on the rate and kind of future development of the soils.

Relief

Relief affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature.

The relief in Johnson County ranges from nearly level to steep. On nearly level to gently sloping soils, such as the Culp, Heiden, Navo, and Wilson soils, most of the rainfall enters the soil and allows for deep development. Some of the more steeply sloping soils, such as the Ferris and Medlin soils, formed in similar parent material, but natural erosion or rapid runoff has kept the surface layer thin and light colored. The solum of these soils is not so thick as that of the soils which formed in less sloping topography.

Some soils, such as the Frio, Gowen, Pulexas, and Tinn soils, are affected by relief in another way. Flooding deposits sediment from the surrounding watersheds.

The strongly sloping to steep Aledo, Bolar, and Brackett soils that are on east- and north-facing slopes have a thicker and darker surface layer than those soils on slopes that face toward the south and west. Where slopes are less exposed to sunlight, the soil temperature is lower and more organic matter accumulates.

Time

Time, usually a long time, is required for formation of soils that have distinct horizons. However, the effects of time are modified by the other four factors of soil development. The differences in the length of time that the parent material has been in place are generally reflected in the degree of development of the soil profile.

The soils in Johnson County range from young to old. The young soils have little horizon development, but the older soils have well expressed soil horizons.

Pulexas soils, which are young soils, show little development. The soil horizons still show the evidence of stratification, and little change has taken place in the original stream alluvium. Crosstell and Gasil soils, which are older soils, have well developed soil horizons. The parent material of these soils has been in place for a long time. Downward movement and accumulation of soil particles have resulted in a distinct Bt horizon.

Geology

Ray C. Cunningham, geologist, Soil Conservation Service, helped prepare this section.

Sediment deposits from the Quaternary Period are the youngest geologic material in Johnson County (fig. 16). These deposits are found in and near the flood plains of rivers and creeks. All other stratigraphic units are of the Cretaceous System. They are as much as 100 million years old and crop out somewhat irregularly. The formations in this system trend north to northeasterly across the county and dip under a sequence of younger beds outcropping to the east.

The Paluxy Sand Formation is the oldest outcropping strata in the county. These strata are in the extreme western part of the county. Beds are composed of fine grained, unconsolidated to poorly cemented, sandstone strata. Clay lenses and clayey shale interbeds have lignite and pyrite nodules. Water-bearing sandstone strata are an aquifer source. The Crosstell and Gasil soils formed within this unit. They are part of several hundred acres near the Brazos River and along the Somervell County line.

Formations of the Fredericksburg Group are the next oldest strata. They are in the west-central and southwestern parts of the county. The Walnut Clay, Comanche Peak Limestone, and Kiamichi Formations average 220 feet in thickness. Shell agglomerate is extensive in the fossiliferous limestone beds of the Comanche Peak Formation, and sandstone and limestone beds make up the Kiamichi Formation. Soils

SYSTEM	GROUP	FORMATION
Quaternary (youngest)	--------------	Alluvium and terrace deposits.
Upper Cretaceous---------	Eagle Ford----	(Undivided).
Upper Cretaceous---------	--------------	Woodbine.
Lower Cretaceous---------	Washita-------	Grayson Marl, Mainstreet Limestone, Paw Paw, Weno Clay, Denton Clay, Fort Worth Limestone, and Duck Creek.
Lower Cretaceous---------	Fredericksburg	Kiamichi, Comanche Peak Limestone, and Walnut Clay.
Lower Cretaceous---------	Trinity-------	Paluxy Sand.

Figure 16.—Geologic column for Johnson County, Texas.

that formed over these formations are Aledo, Bolar, Brackett, Purves, and Sunev soils.

Formations of the Washita Group are next in age. These formations are primarily limestone beds that have interbedded shale strata, varying from sandy to calcareous. They are in the north-central part of the county. These beds thicken and dip down toward the east. The average thickness is 300 feet. Soils that formed within this material are Aledo, Bolar, Krum, Lindale, Ponder, Sanger, and Slidell soils.

Strata of the Woodbine Formation are next in age. They are in the middle and eastern parts of Johnson County. Thin to massively bedded sandstone is interbedded with compact to sandy shale. The total thickness is 230 feet. The water-bearing sandstone beds are a secondary aquifer and are used as a domestic water source. Some of this ground water is highly mineralized. Soils that formed on outcroppings of this material are Birome, Crosstell, Gasil, Rader, Rayex, and Silstid soils.

The youngest marine deposit outcroppings in Johnson County are beds of the Eagle Ford Group. These predominantly shale beds crop out in an irregularly shaped area in the eastern part of the county. The shale beds are interbedded with impure limestone and thin sandstone layers and have an aggregate thickness of 115 feet. Common soils in this outcrop are Burleson, Ferris, Heiden, Houston Black, and Navo soils.

Quaternary deposits, the youngest geologic material, vary from the most recently deposited sediments of mixed sand, gravel, silt, and clay, usually unconsolidated, to ancient fluviatile terraces. These terraces, remnants of old flood plains, are above the present day flood plains. They are Pleistocene deposits about 1.6 million years of age and are part of the Brazos River geomorphic complex. Among the soils that formed in this ancient alluvium are Bastrop, Decordova, Minwells, and Paluxy soils. The present alluvium on the flood plains is the parent material of Frio, Gaddy, Gowen, Pulexas, Pursley, Tinn, and Yahola soils.

The land resource areas in Johnson County include the Blackland Prairie, the East Cross Timbers, and the Grand Prairie Areas and a small part of the West Cross Timbers Area. The Blackland Prairie Land Resource Area is on the Eagle Ford Shale outcrop and is typified by treeless, gently rolling topography. General soil map units 3 and 8 are in the Blackland Prairie Land Resource Area. The East Cross Timbers Land Resource Area is on the Woodbine outcrop and is typified by low hills, reddish sandy soils, and some thickly wooded areas of oak trees. General soil map unit 1 is in the East Cross Timbers Land Resource Area. The Grand Prairie Land Resource Area is on the clay and limestone outcropping beds of the Washita and Fredericksburg Groups. Typically, this area has grassy slopes and low escarpments and relatively few trees. General soil map units 2, 3, 4, 5, and 6 are in the Grand Prairie Land Resource Area. The West Cross Timbers Land Resource Area is on the Paluxy Sand outcrop. It is typified by hummocky topography and thickly wooded areas of oak trees. Several hundred acres are in the Brazos River area. Part of general soil map unit 7 is in the West Cross Timbers Land Resource Area.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0

Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Salty water (in tables). Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded 1951-78 at Cleburne, Texas]

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days[1]	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	58.1	33.4	45.8	83	9	82	1.71	.50	2.69	4	1.4
February---	63.2	37.3	50.3	86	14	129	1.96	.80	2.93	4	.7
March------	70.7	44.3	57.5	92	21	278	2.19	.71	3.39	4	.1
April------	78.8	54.2	66.5	93	33	495	4.25	2.03	6.16	6	.0
May--------	84.9	61.5	73.2	97	43	719	4.44	2.06	6.48	6	.0
June-------	92.8	68.7	80.8	103	54	924	2.93	.64	4.71	4	.0
July-------	97.5	72.1	84.8	108	63	1,079	1.95	.43	3.13	3	.0
August-----	97.6	71.3	84.5	108	61	1,070	2.39	.38	3.91	3	.0
September--	90.2	65.5	77.9	104	48	837	3.04	1.34	4.48	4	.0
October----	80.5	54.5	67.5	96	33	543	3.34	.86	5.32	4	.0
November---	68.0	43.8	55.9	87	22	212	2.30	.74	3.58	4	.0
December---	60.8	36.3	48.6	82	14	82	1.77	.65	2.71	4	.1
Yearly:											
Average--	78.6	53.6	66.1	---	---	---	---	---	---	---	---
Extreme--	---	---	---	109	8	---	---	---	---	---	---
Total----	---	---	---	---	---	6,450	32.27	24.74	39.34	50	2.4

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[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded 1951-78 at Cleburne, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 21	April 3	April 14
2 years in 10 later than--	March 12	March 26	April 8
5 years in 10 later than--	February 24	March 10	March 27
First freezing temperature in fall:			
1 year in 10 earlier than--	November 17	October 30	October 24
2 years in 10 earlier than--	November 25	November 7	October 30
5 years in 10 earlier than--	December 11	November 21	November 11

TABLE 3.--GROWING SEASON

[Recorded 1951-78 at Cleburne, Texas]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	258	222	202
8 years in 10	269	234	211
5 years in 10	290	255	228
2 years in 10	310	277	246
1 year in 10	321	288	255

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AbC	Aledo-Bolar complex, 2 to 8 percent slopes	71,480	15.1
AtB	Altoga silty clay, 2 to 5 percent slopes	1,400	0.3
BaB	Bastrop fine sandy loam, 0 to 3 percent slopes	1,100	0.2
BaC	Bastrop fine sandy loam, 3 to 5 percent slopes	300	0.1
BmE	Birome-Rayex complex, 5 to 20 percent slopes	3,000	0.6
BoB	Bolar clay loam, 1 to 3 percent slopes	7,770	1.6
BoC	Bolar clay loam, 3 to 8 percent slopes	12,600	2.7
BpE	Bolar-Aledo complex, 8 to 20 percent slopes	9,600	2.0
BrE	Brackett-Rock outcrop complex, steep	7,300	1.5
BuA	Burleson clay, 0 to 1 percent slopes	1,700	0.4
BuB	Burleson clay, 1 to 3 percent slopes	1,400	0.3
CaB	Callisburg fine sandy loam, 1 to 3 percent slopes	550	0.1
CoB	Coving loamy fine sand, 0 to 3 percent slopes	330	0.1
CrB	Crosstell fine sandy loam, 1 to 3 percent slopes	23,000	4.9
CrD	Crosstell fine sandy loam, 3 to 8 percent slopes	48,000	10.1
CuB	Culp clay loam, 0 to 3 percent slopes	2,600	0.5
DeC	Decordova loamy fine sand, 0 to 5 percent slopes	490	0.1
DnB	Denton silty clay, 1 to 3 percent slopes	170	*
FeD2	Ferris clay, 5 to 12 percent slopes, eroded	560	0.1
FhC	Ferris-Heiden complex, 2 to 5 percent slopes	12,400	2.6
Fr	Frio silty clay, occasionally flooded	9,200	1.9
GaB	Gasil loamy fine sand, 0 to 5 percent slopes	4,900	1.0
GfB	Gasil fine sandy loam, 1 to 3 percent slopes	7,800	1.7
GfC	Gasil fine sandy loam, 3 to 5 percent slopes	6,450	1.4
GfD4	Gasil fine sandy loam, 1 to 8 percent slopes, gullied	400	0.1
GuD	Gasil-Urban land complex, 1 to 8 percent slopes	50	*
Gw	Gowen clay loam, occasionally flooded	2,600	0.5
Gy	Gowen clay loam, frequently flooded	2,800	0.6
HaA	Hassee fine sandy loam, 0 to 1 percent slopes	2,900	0.6
HeB	Heiden clay, 1 to 3 percent slopes	54,000	11.4
HeD	Heiden clay, 3 to 8 percent slopes	4,900	1.0
HnB	Hensley clay loam, 1 to 3 percent slopes	1,700	0.4
HoA	Houston Black clay, 0 to 1 percent slopes	4,900	1.0
HoB	Houston Black clay, 1 to 3 percent slopes	6,700	1.4
KrB	Krum silty clay, 1 to 3 percent slopes	5,000	1.1
KrC	Krum silty clay, 3 to 5 percent slopes	1,300	0.3
LeB	Lewisville silty clay, 1 to 3 percent slopes	2,500	0.5
LeC	Lewisville silty clay, 3 to 5 percent slopes	1,300	0.3
LlB	Lindale clay loam, 1 to 3 percent slopes	6,640	1.4
LnB	Lindale-Urban land complex, 1 to 3 percent slopes	160	*
LoB	Lott silty clay, 1 to 3 percent slopes	1,800	0.4
LuB	Luckenbach clay loam, 1 to 3 percent slopes	700	0.1
MeE	Medlin clay, 5 to 15 percent slopes	800	0.2
MnB	Minwells fine sandy loam, 1 to 3 percent slopes	950	0.2
MnC2	Minwells fine sandy loam, 2 to 5 percent slopes, eroded	460	0.1
NaC	Navo clay loam, 2 to 5 percent slopes	6,900	1.5
NwB	Navo-Wilson complex, 0 to 3 percent slopes	750	0.2
PaB	Paluxy very fine sandy loam, 1 to 3 percent slopes	720	0.2
Pb	Pits	800	0.2
PnB	Ponder clay loam, 1 to 3 percent slopes	16,010	3.4
PnC	Ponder clay loam, 3 to 5 percent slopes	2,000	0.4
PoB	Ponder-Urban land complex, 1 to 3 percent slopes	2,507	0.5
Pp	Pulexas fine sandy loam, frequently flooded	6,300	1.3
Pr	Pursley clay loam, frequently flooded	1,900	0.4
PuB	Purves clay, 1 to 3 percent slopes	2,500	0.5
PuC	Purves clay, 3 to 5 percent slopes	1,100	0.2
RaB	Rader fine sandy loam, 0 to 3 percent slopes	14,725	3.1
RdB	Rader-Urban land complex, 0 to 3 percent slopes	275	0.1
SaB	Sanger clay, 1 to 3 percent slopes	33,110	7.0
SaC	Sanger clay, 3 to 5 percent slopes	6,800	1.4
SbC	Sanger-Urban land complex, 1 to 5 percent slopes	600	0.1
SeC	Seawillow clay loam, 1 to 5 percent slopes	1,300	0.3
SeE	Seawillow clay loam, 5 to 12 percent slopes	400	0.1
SfB	Silstid loamy fine sand, 1 to 3 percent slopes	4,400	0.9
SfD	Silstid loamy fine sand, 3 to 8 percent slopes	2,400	0.5
SlA	Slidell clay, 0 to 1 percent slopes	3,290	0.7
SlB	Slidell clay, 1 to 3 percent slopes	13,900	2.9
SuB	Sunev clay loam, 1 to 3 percent slopes	900	0.2
SuC	Sunev clay loam, 3 to 5 percent slopes	2,000	0.4
Tn	Tinn clay, frequently flooded	4,100	0.9

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
Us	Ustorthents, loamy	340	0.1
WsA	Wilson silty clay loam, 0 to 1 percent slopes	1,780	0.4
WsB	Wilson silty clay loam, 1 to 3 percent slopes	1,700	0.4
WuB	Wilson-Urban land complex, 0 to 2 percent slopes	220	*
Ya	Yahola-Gaddy complex, occasionally flooded	980	0.2
	Water	2,233	0.5
	Total	473,600	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield figure indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Grain sorghum	Cotton lint	Wheat	Oats	Peanuts	Improved bermudagrass
	Bu	Lb	Bu	Bu	Lb	AUM*
AbC Aledo-Bolar	---	---	---	---	---	---
AtB Altoga	45	250	35	50	---	6.0
BaB Bastrop	55	350	---	---	1,200	7.0
BaC Bastrop	45	300	---	---	800	5.5
BmE Birome-Rayex	---	---	---	---	---	---
BoB Bolar	40	---	35	50	---	5.0
BoC Bolar	---	---	20	30	---	4.5
BpE Bolar-Aledo	---	---	---	---	---	---
BrE Brackett-Rock outcrop	---	---	---	---	---	---
BuA Burleson	85	450	40	80	---	8.0
BuB Burleson	80	450	40	80	---	8.0
CaB Callisburg	50	300	35	50	1,000	5.5
CoB Coving	60	---	30	60	1,200	8.0
CrB Crosstell	40	250	20	45	---	5.0
CrD Crosstell	---	---	---	20	---	4.0
CuB Culp	85	400	35	70	---	8.0
DeC Decordova	40	---	---	---	1,000	5.5
DnB Denton	65	350	40	60	---	6.0
FeD2 Ferris	---	---	---	---	---	4.0
FhC Ferris-Heiden	50	325	30	45	---	6.0
Fr Frio	75	450	40	60	---	7.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Grain sorghum	Cotton lint	Wheat	Oats	Peanuts	Improved bermudagrass
	Bu	Lb	Bu	Bu	Lb	AUM*
GaB---------------------- Gasil	45	200	25	---	1,000	5.0
GfB---------------------- Gasil	55	300	30	---	1,000	5.5
GfC---------------------- Gasil	50	250	25	---	900	5.5
GfD4--------------------- Gasil	---	---	---	---	---	4.0
GuD---------------------- Gasil-Urban land	---	---	---	---	---	---
Gw----------------------- Gowen	70	500	45	80	---	8.0
Gy----------------------- Gowen	---	---	---	---	---	7.0
HaA---------------------- Hassee	45	---	---	50	---	5.0
HeB---------------------- Heiden	80	400	45	80	---	8.0
HeD---------------------- Heiden	35	200	25	50	---	5.0
HnB---------------------- Hensley	25	---	20	40	---	3.5
HoA---------------------- Houston Black	90	550	45	90	---	8.0
HoB---------------------- Houston Black	85	550	45	90	---	8.0
KrB---------------------- Krum	70	400	40	70	---	8.0
KrC---------------------- Krum	65	350	30	60	---	7.0
LeB---------------------- Lewisville	80	500	40	70	---	7.5
LeC---------------------- Lewisville	70	375	30	60	---	7.0
LlB---------------------- Lindale	50	---	30	45	---	5.0
LnB---------------------- Lindale-Urban land	---	---	---	---	---	---
LoB---------------------- Lott	80	400	40	70	---	6.5
LuB---------------------- Luckenbach	55	400	30	50	---	5.0
MeE---------------------- Medlin	---	---	---	---	---	4.0
MnB---------------------- Minwells	45	---	---	40	1,100	5.5

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Grain sorghum	Cotton lint	Wheat	Oats	Peanuts	Improved bermudagrass
	Bu	Lb	Bu	Bu	Lb	AUM*
MnC2------------------------ Minwells	30	---	---	30	800	4.0
NaC------------------------- Navo	50	---	30	50	---	7.0
NwB------------------------- Navo-Wilson	50	300	30	50	---	7.4
PaB------------------------- Paluxy	50	300	---	---	1,100	6.5
Pb.** Pits						
PnB------------------------- Ponder	65	---	35	50	---	6.0
PnC------------------------- Ponder	---	---	25	40	---	5.0
PoB------------------------- Ponder-Urban land	---	---	---	---	---	---
Pp-------------------------- Pulexas	---	---	---	---	---	7.5
Pr-------------------------- Pursley	---	---	---	---	---	8.0
PuB------------------------- Purves	35	---	20	45	---	4.0
PuC------------------------- Purves	25	---	20	40	---	3.5
RaB------------------------- Rader	70	---	30	50	---	8.0
RdB------------------------- Rader-Urban land	---	---	---	---	---	---
SaB------------------------- Sanger	70	350	40	80	---	7.0
SaC------------------------- Sanger	65	300	30	60	---	6.0
SbC------------------------- Sanger-Urban land	---	---	---	---	---	---
SeC------------------------- Seawillow	40	200	25	40	---	5.0
SeE------------------------- Seawillow	---	---	---	---	---	4.0
SfB------------------------- Silstid	40	---	---	---	1,000	5.5
SfD------------------------- Silstid	30	---	---	---	800	5.0
SlA------------------------- Slidell	80	400	40	80	---	7.0
SlB------------------------- Slidell	70	350	35	80	---	7.0

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Grain sorghum	Cotton lint	Wheat	Oats	Peanuts	Improved bermudagrass
	Bu	Lb	Bu	Bu	Lb	AUM*
SuB Sunev	55	250	35	55	---	6.5
SuC Sunev	35	200	30	50	---	5.5
Tn Tinn	---	---	---	---	---	8.0
Us.** Ustorthents						
WsA, WsB Wilson	55	350	35	50	---	6.0
WuB Wilson-Urban land	---	---	---	---	---	---
Ya Yahola-Gaddy	45	---	30	---	1,000	7.5

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* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Normal Lb/acre	Unfavorable Lb/acre
AbC:*				
Aledo	Shallow	3,000	2,000	1,800
Bolar	Clay Loam	6,000	5,000	3,000
AtB Altoga	Clay Loam	6,000	5,000	3,500
BaB, BaC Bastrop	Sandy Loam	5,500	4,500	3,000
BmE:*				
Birome	Sandstone Hill	4,500	3,500	2,000
Rayex	Sandstone Hill	3,500	2,500	1,500
BoB, BoC Bolar	Clay Loam	6,000	5,000	3,000
BpE:*				
Bolar	Clay Loam Slopes	5,500	4,500	2,700
Aledo	Shallow	2,500	1,800	1,200
BrE:*				
Brackett	Steep Adobe	3,000	2,200	1,500
Rock outcrop.				
BuA, BuB Burleson	Blackland	7,000	5,500	4,000
CaB Callisburg	Sandy Loam	6,000	4,500	3,500
CoB Coving	Sandy	6,000	5,000	3,000
CrB, CrD Crosstell	Tight Sandy Loam	4,500	3,500	2,000
CuB Culp	Clay Loam	6,000	5,000	3,000
DeC Decordova	Loamy Sand	5,000	4,000	2,000
DnB Denton	Clay Loam	6,500	5,000	3,000
FeD2 Ferris	Eroded Blackland	4,500	3,000	2,000
FhC:*				
Ferris	Eroded Blackland	4,500	3,000	2,000
Heiden	Blackland	5,500	4,500	3,500
Fr Frio	Loamy Bottomland	5,500	4,000	3,000
GaB Gasil	Loamy Sand	6,500	5,000	4,000
GfB, GfC, GfD4 Gasil	Sandy Loam	5,500	4,000	3,500

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Normal Lb/acre	Unfavorable Lb/acre
Gw, Gy Gowen	Loamy Bottomland	8,000	5,500	4,000
HaA Hassee	Claypan Prairie	5,000	4,000	2,000
HeB, HeD Heiden	Blackland	7,000	6,000	3,500
HnB Hensley	Redland	7,000	4,000	3,000
HoA, HoB Houston Black	Blackland	7,000	6,000	3,500
KrB, KrC Krum	Clay Loam	6,500	6,000	4,000
LeB, LeC Lewisville	Clay Loam	6,500	5,500	3,500
LlB Lindale	Deep Redland	6,000	5,000	4,000
LoB Lott	Clay Loam	6,500	5,000	3,000
LuB Luckenbach	Clay Loam	5,000	4,000	3,000
MeE Medlin	Eroded Blackland	5,000	4,000	3,000
MnB, MnC2 Minwells	Sandy Loam	5,000	4,000	3,000
NaC Navo	Claypan Prairie	6,000	4,000	3,500
NwB:*				
Navo	Claypan Prairie	6,000	4,000	3,500
Wilson	Claypan Prairie	6,000	4,500	3,000
PaB Paluxy	Sandy Loam	5,500	4,500	3,000
PnB, PnC Ponder	Claypan Prairie	5,500	4,000	2,000
Pp Pulexas	Loamy Bottomland	6,500	5,000	3,500
Pr Pursley	Loamy Bottomland	7,500	5,500	4,000
PuB, PuC Purves	Shallow	3,000	2,500	1,800
RaB Rader	Sandy Loam	6,000	4,500	3,500
SaB, SaC Sanger	Blackland	6,000	5,000	3,000
SeC, SeE Seawillow	Clay Loam	5,000	4,000	2,500

Footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable Lb/acre	Normal Lb/acre	Unfavorable Lb/acre
SfB, SfD------------------ Silstid	Sandy-------------------------------------	4,500	4,000	2,000
SlA, SlB------------------ Slidell	Blackland---------------------------------	6,000	5,000	3,000
SuB, SuC------------------ Sunev	Clay Loam---------------------------------	7,000	5,500	3,500
Tn------------------------ Tinn	Clayey Bottomland-------------------------	7,000	6,000	4,000
WsA, WsB------------------ Wilson	Claypan Prairie---------------------------	6,000	4,500	3,000
Ya:*				
Yahola-------------------	Loamy Bottomland--------------------------	7,000	4,900	3,500
Gaddy--------------------	Sandy Bottomland--------------------------	3,800	2,700	2,000

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AbC:* Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
Bolar	Slight	Slight	Moderate: small stones, slope.	Slight	Moderate: thin layer.
AtB Altoga	Slight	Slight	Moderate: slope.	Slight	Moderate: excess lime.
BaB Bastrop	Slight	Slight	Slight	Slight	Slight.
BaC Bastrop	Slight	Slight	Moderate: slope.	Slight	Slight.
BmE:* Birome	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope, thin layer.
Rayex	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock, large stones.	Slight	Severe: thin layer.
BoB, BoC Bolar	Slight	Slight	Moderate: small stones, slope.	Slight	Moderate: thin layer.
BpE:* Bolar	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: large stones, slope, thin layer.
Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight	Severe: thin layer.
BrE:* Brackett	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
Rock outcrop.					
BuA Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
BuB Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
CaB Callisburg	Slight	Slight	Moderate: slope.	Slight	Slight.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
CoB Coving	Severe: flooding.	Slight	Slight	Slight	Moderate: droughty.
CrB, CrD Crosstell	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
CuB Culp	Slight	Slight	Moderate: small stones.	Slight	Slight.
DeC Decordova	Slight	Slight	Moderate: slope.	Slight	Slight.
DnB Denton	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
FeD2 Ferris	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
FhC:*					
Ferris	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
Heiden	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
Fr Frio	Severe: flooding.	Severe: too clayey.	Severe: too clayey.	Moderate: too clayey.	Severe: too clayey.
GaB, GfB, GfC, GfD4 Gasil	Slight	Slight	Moderate: slope.	Slight	Slight.
GuD:*					
Gasil	Slight	Slight	Moderate: slope.	Slight	Slight.
Urban land.					
Gw Gowen	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Gy Gowen	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
HaA Hassee	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Slight	Moderate: wetness.
HeB, HeD Heiden	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
HnB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
HoA Houston Black	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
HoB Houston Black	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
KrB, KrC Krum	Moderate: too clayey.	Moderate: too clayey.	Moderate: small stones, slope.	Moderate: too clayey.	Severe: too clayey.
LeB, LeC Lewisville	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
LlB Lindale	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
LnB:*					
Lindale	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Urban land.					
LoB Lott	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
LuB Luckenbach	Slight	Slight	Moderate: slope.	Slight	Slight.
MeE Medlin	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
MnB, MnC2 Minwells	Slight	Slight	Moderate: slope.	Slight	Slight.
NaC Navo	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
NwB:*					
Navo	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: percs slowly.	Slight	Slight.
Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
PaB Paluxy	Slight	Slight	Moderate: slope.	Slight	Slight.
Pb.* Pits					
PnB, PnC Ponder	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
PoB:*					
Ponder	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight	Slight.
Urban land.					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Pp Pulexas	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Pr Pursley	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
PuB, PuC Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.	Severe: thin layer, too clayey.
RaB Rader	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
RdB:* Rader	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
Urban land.					
SaB, SaC Sanger	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
SbC:* Sanger	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
Urban land.					
SeC Seawillow	Slight	Slight	Moderate: slope.	Slight	Moderate: excess lime.
SeE Seawillow	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope, excess lime.
SfB, SfD Silstid	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
SlA Slidell	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
SlB Slidell	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
SuB, SuC Sunev	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: excess lime.
Tn Tinn	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
Us.* Ustorthents					

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
WsA, WsB Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
WuB:*					
Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
Urban land.					
Ya:*					
Yahola	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
Gaddy	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: droughty, flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--SELECTED SUITABLE PLANTS

[Only those map units suitable for flowers and ground cover, vines, shrubs, or trees are listed]

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
AbC, BpE*----------- Aledo	Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia.	Banksia rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca.	Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, juniper, redcedar, Mexican plum, redbud, live oak, Texas oak, Texas persimmon.
AtB----------------- Altoga	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, mulberry, oaks, peach, pecan, plum, redbud, redcedar.
BaB, BaC------------ Bastrop	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, juniper, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Aucuba, azalea, barberry, butterflybush, camellia, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, Pfitzer juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.
BmE*---------------- Birome	Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage.	Aleppo pine, American pine, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, mulberry, post oak, tulip-poplar.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
AbC, BoB, BoC, BpE* Bolar	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, mulberry, oaks, peach, pear, pecan, plum, redbud, redcedar.
BrE*---------------- Brackett	Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia.	Banksia rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca.	Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, juniper, redcedar, Mexican plum, redbud, live oak, Texas oak, Texas persimmon.
BuA, BuB------------ Burleson	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
CaB----------------- Callisburg	Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, mulberry, post oak, tulip-poplar.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
CoB----------------- Coving	Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, juniper, marigold, ornamental pepper, pansies, periwinkle, petunia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, aucuba, azalea, barberry, boxwood, camellia, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, Indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses.	Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow.
CrB, CrD------------ Crosstell	Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, mulberry, post oak, tulip-poplar.
CuB----------------- Culp	Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper.	Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, Pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca.	Aleppo pine, American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar.
DeC----------------- Decordova	Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, juniper, marigold, ornamental pepper, pansies, periwinkle, petunia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, aucuba, azalea, barberry, boxwood, camellia, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, Indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses.	Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
DnB: Denton	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
FeD2, FhC*: Ferris	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
Fr: Frio	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
Ya*: Gaddy	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
GaB, GfB, GfC, GfD4, GuD*: Gasil	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, juniper, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Aucuba, azalea, barberry, butterflybush, camellia, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, Pfitzer juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.
Gw, Gy: Gowen	Ajuga, amaryllis, aspidistra, blue fescue, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, hibiscus, hollies, hollyhock, jessamine, juniper, lantana, marigold, ornamental pepper, pansies, periwinkle, petunia, phlox, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, aucuba, althea, azaleas, Barbados-cherry, barberry, bottlebrush, bougainvillea, boxwood, bridalwreath, camellia, duranta, goldflower, guava, Indian hawthorn, jasmine, loquat, mahonia, pomegranate, roses, Texas laurel, Texas sage.	American elm, arborvitae, baldcypress, bur oak, cottonless cottonwood, Japanese black pine, live oak, magnolia, maple, mountain laurel, peach, pecan, plum, sweetgum, sycamore, tulip-poplar, water oak.
HaA: Hassee	Agapanthus, ajuga, amaryllis, aspidistra, aster, caladium, canna, cornflower, daylily, dwarf bamboo, euonymus, hollyhock, honeysuckle, lantana, liriope, moneywort, ophiopogon, plumbago, potentilla, salvia, Shasta daisy, vinca, zinnia.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	American holly, bottlebrush, bridalwreath, deutzia, forsythia, goldflower, hydrangea, jasmine, ligustrum, oleander, Pfitzer juniper, pomegranate, pyracantha, quince.	Aleppo pine, American elm, Arizona ash, baldcypress, bur oak, cedar elm, cedrus, Chinese pistache, Chinese tallowtree, deodar cedar, hackberry, live oak, magnolia, mulberry, peach, pecan, plum, redbud, redcedar, sweetgum, tulip-poplar, water oak, weeping willow.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
PhC, HeB, HeD*: Heiden	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet crceper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple,ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
HnB: Hensley	Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia.	Banksia rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca.	Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, juniper, redcedar, Mexican plum, redbud, live oak, Texas oak, Texas persimmon.
HoA, HoB: Houston Black	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
KrB, KrC: Krum	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, redcedar, mulberry, oaks, peach, pear, pecan, plum, redbud.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
LeB, LeC------------ Lewisville	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, redcedar, mulberry, oaks, peach, pear, pecan, plum, redbud.
LlB, LnB*----------- Lindale	Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywort, ophiopgon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper.	Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca.	Aleppo pine, American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, Japanese black pine, redcedar, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar.
LoB----------------- Lott	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, redcedar, mulberry, oaks, peach, pear, pecan, plum, redbud.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
LuB---------------- Luckenbach	Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper.	Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, Pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca.	Aleppo pine, American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar.
MeE---------------- Medlin	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
MnB, MnC2----------- Minwells	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, juniper, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Aucuba, azalea, barberry, butterflybush, camellia, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, Pfitzer juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
NaC, NwB*: Navo	Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper.	Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, Pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca.	Aleppo pine, American elm, arborvitae, Arizona ash, baldcypress, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar.
PaB: Paluxy	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, juniper, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Aucuba, azalea, barberry, butterflybush, camellia, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, Pfitzer juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.
PnB, PnC, PoB*: Ponder	Agapanthus, alyssum, amaryllis, aspidistra, aster, caladium, canna, copperleaf, cornflower, daylily, dichondra, dwarf bamboo, hollyhock, lantana, marigold, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, grapes, honeysuckle, trumpet creeper, Virginia creeper.	Bottlebrush, bougainvillea, bridalwreath, gardenia, goldflower, jasmine, ligustrum, oleander, Pfitzer juniper, pomegranate, pyracantha, quince, Texas sage, yucca.	Aleppo pine, American pine, arborvitae, Arizona ash, baldcypress, cedar pistache, Chinese pistache, Chinese tallowtree, cottonwood, Japanese black pine, live oak, maple, mountain laurel, mulberry, peach, pecan, plum, sycamore, tulip-poplar.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
Pp----------------- Pulexas	Ajuga, amaryllis, aspidistra, blue fescue, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, hibiscus, hollies, hollyhock, jessamine, juniper, lantana, marigold, ornamental pepper, pansies, periwinkle, petunia, phlox, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, aucuba, althea, azalea, Barbados-cherry, barberry, bottlebrush, bougainvillea, boxwood, bridalwreath, camellia, duranta, goldflower, guava, Indian hawthorn, jasmine, loquat, mahonia, pomegranate, roses, Texas laurel, Texas sage.	American elm, arborvitae, baldcypress, bur oak, cottonless cottonwood, Japanese black pine, live oak, magnolia, maple, mountain laurel, peach, pecan, plum, sweetgum, sycamore, tulip-poplar, water oak.
Pr----------------- Pursley	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
PuB, PuC----------- Purves	Alyssum, blue fescue, calendula, copperleaf, daylily, dianthus, euonymus, geranium, green and gray santolina, iris, lantana, narcissus, periwinkle, petunia, sedum, Shasta daisy, verbena, vinca, zinnia.	Banksia rose, Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Abelia, Barbados-cherry, bottlebrush, eleagnus, guava, hollies, Japanese ligustrum, nandina, photinia, pomegranate, pyracantha, quince, spirea, Texas sage, yucca.	Arizona cypress, cedar elm, Chinese tallowtree, deodar cedar, juniper, redcedar, Mexican plum, redbud, live oak, Texas oak, Texas persimmon.
RdB, RdB*---------- Rader	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, junipers, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Aucuba, azalea, barberry, butterflybush, camellia, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, Pfitzer juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
BmE*: Rayex	Alyssum, amaryllis, aspidistra, aster, azalea, camellia, canna, dahlia, daylily, dichondra, dwarf bamboo, geranium, hydrangea, moneywort, ophiopogon, ornamental pepper, plumbago, potentilla, Shasta daisy, vinca.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	Barbados-cherry, butterflybush, gardenia, hydrangea, jasmine, ligustrum, oleander, pomegranate, pyracantha, quince, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, Chinese tallowtree, cottonwood, mulberry, post oak, tulip-poplar.
SaB, SaC, SbC*: Sanger	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
SeC, SeE: Seawillow	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, redcedar, mulberry, oaks, peach, pear, pecan, plum, redbud.
SfB, SfD: Silstid	Agapanthus, aspidistra, aster, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, gladiolus, hibiscus, hollies, hyacinth, jessamine, juniper, marigold, ornamental pepper, pansies, periwinkle, petunia.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Abelia, aucuba, azalea, barberry, boxwood, camellia, cotoneaster, crapemyrtle, eleagnus, fatsia, gardenia, goldflower, guava, hollies, Indian hawthorn, ligustrum, mahonia, mockorange, nandina, pittosporum, pomegranate, pyracantha, quince, roses.	Arizona ash, baldcypress, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering cherry, magnolia, mountain laurel, oaks, pear, pecan, pines, plum, sweetgum, weeping willow.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
SlA, SlB: Slidell	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.
SuB, SuC: Sunev	Amaryllis, Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, daylily, dwarf juniper, dwarf nandina, dwarf yaupon, euonymus, geranium, gladiolus, hollyhock, lantana, marigold, narcissus, pansies, periwinkle, potentilla, Shasta daisy, snapdragon, verbena, vinca, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, English ivy, honeysuckle, mustang grape, roses, trumpet creeper, Virginia creeper.	Abelia, aucuba, Barbados-cherry, bottlebrush, bougainvillea, bridalwreath, crapemyrtle, duranta, fatsia, guava, Japanese ligustrum, loquat, mahonia, nandina, oleander, pittosporum, pomegranate, pyracantha, quince, Texas laurel, Texas sage, yucca.	Arborvitae, Arizona ash, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, live oak, mulberry, oaks, peach, pear, pecan, plum, redbud, redcedar.
Tn: Tinn	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.

See footnote at end of table.

TABLE 8.--SELECTED SUITABLE PLANTS--Continued

Map symbol and soil name	Flowers and ground cover	Vines	Shrubs	Trees
Us------------------ Ustorthents	Agapanthus, aspidistra, begonia, blue fescue, caladium, calendula, canna, chrysanthemum, cornflower, dianthus, dwarf abelia, dwarf yaupon, English ivy, geranium, hibiscus, hollies, hyacinth, iris, jessamine, juniper, narcissus, ornamental pepper, pansies, petunia, phlox.	Banksia rose, Boston ivy, Carolina jessamine, clematis, climbing fig, Confederate jasmine, English ivy, grapes, Virginia creeper, wisteria.	Aucuba, azalea, barberry, butterflybush, camellia, crapemyrtle, eleagnus, gardenia, goldflower, hollies, mahonia, oleander, Pfitzer juniper, pittosporum, pomegranate, pyracantha, roses.	American elm, Arizona ash, cedar elm, Chinese pistache, deodar cedar, dogwood, flowering crabapple, magnolia, mountain laurel, oaks, peach, pear, pecan, pines, plum, sweetgum.
NwB, WsA, WsB, WuB* Wilson	Agapanthus, ajuga, amaryllis, aspidistra, aster, caladium, canna, cornflower, daylily, dwarf bamboo, euonymus, hollyhock, honeysuckle, lantana, liriope, moneywort, ophiopogon, plumbago, potentilla, salvia, Shasta daisy, vinca, zinnia.	Boston ivy, honeysuckle, trumpet creeper, Virginia creeper.	American holly, bottlebrush, bridalwreath, deutzia, forsythia, goldflower, hydrangea, jasmine, ligustrum, oleander, Pfitzer juniper, pomegranate, pyracantha, quince.	Aleppo pine, American elm, Arizona ash, baldcypress, bur oak, cedar elm, cedrus, Chinese pistache, Chinese tallowtree, deodar cedar, hackberry, oak, magnolia, mulberry, peach, pecan, plum, redbud, redcedar, sweetgum, tulip-poplar, water oak, weeping willow.
Ya*----------------- Yahola	Asiatic jasmine, canna, Carolina jessamine, chrysanthemum, copperleaf, cornflower, dahlia, daylily, dianthus, dwarf juniper, dwarf nandina, dwarf yaupon, English ivy, euonymus, gladiolus, hibiscus, hollyhock, iris, lantana, marigold, narcissus, ophiopogon, periwinkle, petunia, potentilla, Shasta daisy, verbena, zinnia.	Banksia rose, Boston ivy, Carolina jessamine, climbing fig, mustang grape, honeysuckle, roses, trumpet creeper.	Abelia, aucuba, bridalwreath, crapemyrtle, duranta, fatsia, goldflower, guava, ligustrum, loquat, mahonia, oleander, pittosporum, pomegranate, privet, Texas laurel, Texas sage.	Aleppo pine, American elm, cedar elm, Chinese pistache, crabapple, ginkgo, hackberry, Japanese black pine, oaks, peach, pecan, plum, redbud, sweetgum.

*This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AbC:*									
Aledo	Poor	Poor	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor.
Bolar	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
AtB Altoga	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
BaB Bastrop	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
BaC Bastrop	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
BmE:*									
Birome	Very poor	Very poor	Good	Good	Poor	Very poor	Poor	Very poor	Good.
Rayex	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
BoB Bolar	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
BoC Bolar	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
BpE:*									
Bolar	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
Aledo	Very poor	Very poor	Poor	Fair	Very poor	Very poor	Very poor	Very poor	Poor.
BrE:*									
Brackett	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.									
BuA, BuB Burleson	Good	Good	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
CaB Callisburg	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
CoB Coving	Fair	Good	Good	Good	Fair	Poor	Good	Poor	Good.
CrB Crosstell	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Fair.
CrD Crosstell	Poor	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Fair.
CuB Culp	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
DeC Decordova	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
DnB Denton	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
FeD2 Ferris	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
FhC:*									
Ferris	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Fr Frio	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
GaB Gasil	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
GfB, GfC, GfD4 Gasil	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
GuD:*									
Gasil	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
Urban land.									
Gw Gowen	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.
Gy Gowen	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
HaA Hassee	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
HeB Heiden	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
HeD Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
HnB Hensley	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
HoA, HoB Houston Black	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
KrB Krum	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
KrC Krum	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
LeB Lewisville	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
LeC Lewisville	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
LlB Lindale	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
LnB:*									
Lindale	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Urban land.									
LoB Lott	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
LuB Luckenbach	Good	Good	Fair	Good	Poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
MeE----------------- Medlin	Fair	Fair	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
MnB----------------- Minwells	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
MnC2---------------- Minwells	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
NaC----------------- Navo	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
NwB:*									
Navo----------------	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Wilson--------------	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
PaB----------------- Paluxy	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Pb.* Pits									
PnB, PnC------------ Ponder	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
PoB:*									
Ponder--------------	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
Urban land.									
Pp------------------ Pulexas	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
Pr------------------ Pursley	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
PuB, PuC------------ Purves	Fair	Good	Poor	Fair	Poor	Very poor	Fair	Very poor	Poor.
RaB----------------- Rader	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
RdB:*									
Rader---------------	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
Urban land.									
SaB----------------- Sanger	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
SaC----------------- Sanger	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
SbC:*									
Sanger--------------	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Urban land.									
SeC----------------- Seawillow	Fair	Good	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
SeE----------------- Seawillow	Poor	Fair	Fair	Good	Very poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
SfB, SfD----------- Silstid	Poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
SlA, SlB----------- Slidell	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
SuB---------------- Sunev	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
SuC---------------- Sunev	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Tn----------------- Tinn	Poor	Fair	Fair	Good	Poor	Fair	Fair	Poor	Fair
Us.* Ustorthents									
WsA, WsB----------- Wilson	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
WuB:* Wilson------------	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.
Urban land.									
Ya:* Yahola------------	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Gaddy-------------	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AbC:*						
Aledo	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock.	Severe: thin layer.
Bolar	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Moderate: thin layer.
AtB Altoga	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: excess lime.
BaB Bastrop	Slight	Slight	Slight	Slight	Moderate: low strength.	Slight.
BaC Bastrop	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.	Slight.
BmE:*						
Birome	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: large stones, slope, thin layer.
Rayex	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Severe: thin layer.
BoB Bolar	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: thin layer.
BoC Bolar	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.	Moderate: thin layer.
BpE:*						
Bolar	Moderate: depth to rock, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, shrink-swell.	Moderate: large stones, slope, thin layer.
Aledo	Severe: depth to rock.	Moderate: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock.	Severe: thin layer.
BrE:*						
Brackett	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope, thin layer.
Rock outcrop.						
BuA, BuB Burleson	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
CaB Callisburg	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
CoB Coving	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
CrB, CrD---------- Crosstell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
CuB--------------- Culp	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
DeC--------------- Decordova	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
DnB--------------- Denton	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
FeD2-------------- Ferris	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
FhC:*						
Ferris------------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Heiden------------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Fr---------------- Frio	Moderate: too clayey, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: too clayey.
GaB, GfB---------- Gasil	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Slight.
GfC, GfD4--------- Gasil	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Slight.
GuD:*						
Gasil-------------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.	Slight.
Urban land.						
Gw---------------- Gowen	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding.
Gy---------------- Gowen	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
HaA--------------- Hassee	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: wetness.
HeB, HeD---------- Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
HnB--------------- Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength.	Severe: thin layer.
HoA, HoB---------- Houston Black	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
KrB, KrC Krum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
LeB, LeC Lewisville	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
LlB Lindale	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
LnB:* Lindale	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
Urban land.						
LoB Lott	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Severe: too clayey.
LuB Luckenbach	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
MeE Medlin	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
MnB, MnC2 Minwells	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
NaC Navo	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
NwB:* Navo	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
PaB Paluxy	Slight	Slight	Slight	Slight	Slight	Slight.
Pb.* Pits						
PnB Ponder	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
PnC Ponder	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Slight.
PoB:* Ponder	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
Urban land.						
Pp Pulexas	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Pr----------------- Pursley	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
PuB, PuC----------- Purves	Severe: depth to rock.	Severe: shrink-swell, depth to rock.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell, depth to rock.	Severe: depth to rock, low strength, shrink-swell.	Severe: thin layer, too clayey.
RaB---------------- Rader	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Slight.
RdB:*						
Rader--------------	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Slight.
Urban land.						
SaB, SaC----------- Sanger	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
SbC:*						
Sanger-------------	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Urban land.						
SeC---------------- Seawillow	Slight----------	Moderate: shrink-swell.	Slight----------	Moderate: shrink-swell.	Severe: low strength.	Moderate: excess lime.
SeE---------------- Seawillow	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope, excess lime.
SfB---------------- Silstid	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: droughty.
SfD---------------- Silstid	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
SlA, SlB----------- Slidell	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
SuB---------------- Sunev	Slight----------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: excess lime.
SuC---------------- Sunev	Slight----------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: excess lime.
Tn----------------- Tinn	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.
Us.* Ustorthents						
WsA, WsB----------- Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
WuB:*						
Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Urban land.						
Ya:*						
Yahola	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Gaddy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: droughty, flooding.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AbC:*					
Aledo	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Bolar	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
AtB Altoga	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, excess lime.
BaB Bastrop	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
BaC Bastrop	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
BmE:*					
Birome	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Rayex	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey.
BoB, BoC Bolar	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
BpE:*					
Bolar	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Aledo	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
BrE:*					
Brackett	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
BuA Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BuB Burleson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CaB Callisburg	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CoB Coving	Severe: wetness, poor filter.	Severe: seepage, wetness.	Moderate: flooding, wetness, too sandy.	Severe: seepage.	Poor: seepage.
CrB, CrD Crosstell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CuB Culp	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
DeC Decordova	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
DnB Denton	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
FeD2 Ferris	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
FhC:*					
Ferris	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Fr Frio	Severe: flooding, percs slowly.	Slight	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
GaB, GfB, GfC, GfD4 Gasil	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
GuD:*					
Gasil	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Urban land.					
Gw, Gy Gowen	Severe: flooding.	Moderate: seepage.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
HaA Hassee	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
HeB, HeD Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
HnB Hensley	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
HoA Houston Black	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
HoB Houston Black	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
KrB, KrC Krum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LeB, LeC Lewisville	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LlB Lindale	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LnB:*					
Lindale	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
LoB Lott	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LuB Luckenbach	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
MeE Medlin	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
MnB, MnC2 Minwells	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey.
NaC Navo	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
NwB:*					
Navo	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Wilson	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
PaB Paluxy	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Pb.* Pits					
PnB, PnC Ponder	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
PoB:* Ponder	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
Pp Pulexas	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
Pr Pursley	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
PuB, PuC Purves	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
RaB Rader	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Moderate: too clayey, wetness.
RdB:* Rader	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Moderate: too clayey, wetness.
Urban land.					
SaB, SaC Sanger	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SbC:* Sanger	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
Urban land.					
SeC Seawillow	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, excess lime.
SeE Seawillow	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope, excess lime.
SfB, SfD Silstid	Slight	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
SlA Slidell	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SlB Slidell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
SuB, SuC Sunev	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, excess lime.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Tn------------------- Tinn	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Us.* Ustorthents					
WsA, WsB------------ Wilson	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
WuB:*					
Wilson-------------	Severe: wetness, percs slowly.	Slight-----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					
Ya:*					
Yahola-------------	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Good.
Gaddy--------------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: too sandy, seepage.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AbC:*				
Aledo	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Bolar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
AtB Altoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
BaB, BaC Bastrop	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
BmE:*				
Birome	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, too clayey.
Rayex	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
BoB, BoC Bolar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
BpE:*				
Bolar	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Aledo	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
BrE:*				
Brackett	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
BuA, BuB Burleson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CaB Callisburg	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CoB Coving	Fair: wetness.	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
CrB, CrD Crosstell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CuB Culp	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
DeC Decordova	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
DnB Denton	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
FeD2 Ferris	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
FhC:*				
Ferris	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Heiden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Fr Frio	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GaB Gasil	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
GfB, GfC, GfD4 Gasil	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
GuD:*				
Gasil	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
Gw, Gy Gowen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
HaA Hassee	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
HeB, HeD Heiden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
HnB Hensley	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
HoA, HoB Houston Black	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KrB, KrC Krum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LeB, LeC Lewisville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LlB Lindale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
LnB:*				
Lindale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, too clayey.
Urban land.				
LoB Lott	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LuB Luckenbach	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MeE Medlin	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
MnB, MnC2 Minwells	Good	Probable	Probable	Poor: too clayey.
NaC Navo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
NwB:*				
Navo	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Wilson	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
PaB Paluxy	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Pb.* Pits				
PnB, PnC Ponder	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
PoB:*				
Ponder	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Urban land.				
Pp Pulexas	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Pr Pursley	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
PuB, PuC Purves	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, small stones.
RaB Rader	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
RdB:*				
Rader	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
SaB, SaC Sanger	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SbC:*				
Sanger	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Urban land.				
SeC, SeE Seawillow	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: excess lime.
SfB, SfD Silstid	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy.
SlA, SlB Slidell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SuB, SuC Sunev	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, excess lime.
Tn Tinn	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Us.* Ustorthents				
WsA, WsB Wilson	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
WuB:*				
Wilson	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Urban land.				
Ya:*				
Yahola	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Gaddy	Good	Probable	Improbable: too sandy.	Poor: too sandy.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation]

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AbC:*						
Aledo	Severe: depth to rock.	Severe: thin layer.	Deep to water	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty.
Bolar	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
AtB Altoga	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Slope, excess lime.	Favorable	Excess lime.
BaB Bastrop	Moderate: seepage.	Moderate: piping.	Deep to water	Soil blowing	Erodes easily, soil blowing.	Erodes easily.
BaC Bastrop	Moderate: seepage.	Moderate: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
BmE:*						
Birome	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Rayex	Severe: depth to rock.	Severe: thin layer.	Deep to water	Droughty, depth to rock.	Slope, depth to rock, large stones.	Slope, droughty.
BoB Bolar	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
BoC Bolar	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
BpE:*						
Bolar	Moderate: seepage, depth to rock.	Moderate: thin layer, piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Aledo	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
BrE:*						
Brackett	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Large stones, slope, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.						
BuA, BuB Burleson	Slight	Severe: hard to pack.	Not needed	Slow intake, percs slowly.	Percs slowly	Percs slowly.
CaB Callisburg	Slight	Moderate: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
CoB Coving	Severe: seepage.	Severe: seepage, piping.	Cutbanks cave	Wetness, droughty, fast intake.	Wetness	Droughty.
CrB Crosstell	Slight	Moderate: hard to pack.	Deep to water	Soil blowing, percs slowly.	Erodes easily, soil blowing.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
CrD Crosstell	Slight	Moderate: hard to pack.	Deep to water	Soil blowing, percs slowly, slope.	Erodes easily, soil blowing.	Erodes easily, percs slowly.
CuB Culp	Slight	Moderate: hard to pack.	Deep to water	Percs slowly	Erodes easily, percs slowly.	Erodes easily, percs slowly.
DeC Decordova	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
DnB Denton	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
FeD2 Ferris	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
FhC:*						
Ferris	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
Heiden	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
Fr Frio	Slight	Moderate: hard to pack.	Deep to water	Slow intake, flooding.	Favorable	Favorable.
GaB Gasil	Moderate: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing	Favorable.
GfB Gasil	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
GfC, GfD4 Gasil	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
GuD:*						
Gasil	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
Urban land.						
Gw, Gy Gowen	Moderate: seepage.	Moderate: piping.	Not needed	Flooding	Favorable	Favorable.
HaA Hassee	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly, erodes easily.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
HeB Heiden	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
HeD Heiden	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
HnB Hensley	Severe: depth to rock.	Severe: thin layer.	Deep to water	Soil blowing, percs slowly, depth to rock.	Depth to rock, erodes easily, soil blowing.	Erodes easily, depth to rock, percs slowly.
HoA, HoB Houston Black	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
KrB Krum	Slight	Severe: hard to pack.	Deep to water	Slow intake	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
KrC Krum	Slight	Severe: hard to pack.	Deep to water	Slow intake, slope.	Favorable	Favorable.
LeB Lewisville	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Slow intake	Erodes easily	Erodes easily.
LeC Lewisville	Moderate: seepage.	Moderate: piping, hard to pack.	Deep to water	Slow intake, slope.	Erodes easily	Erodes easily.
LlB Lindale	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
LnB:*						
Lindale	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Urban land.						
LoB Lott	Moderate: seepage.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake	Favorable	Favorable.
LuB Luckenbach	Slight	Slight	Deep to water	Favorable	Favorable	Favorable.
MrE Medlin	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, percs slowly.	Slope, percs slowly.
MnB Minwells	Moderate: seepage.	Moderate: thin layer.	Deep to water	Soil blowing, percs slowly.	Soil blowing, percs slowly.	Percs slowly.
MnC2 Minwells	Moderate: seepage.	Moderate: thin layer.	Deep to water	Soil blowing, percs slowly, slope.	Soil blowing, percs slowly.	Percs slowly.
NaC Navo	Slight	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
NwB:*						
Navo	Slight	Severe: hard to pack.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
Wilson	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
PaB Paluxy	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Pb.* Pits						
PnB, PnC Ponder	Slight	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
PoB:*						
Ponder	Slight	Severe: hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
Urban land.						
Pp Pulexas	Severe: seepage.	Severe: piping.	Deep to water	Flooding	Favorable	Favorable.
Pr Pursley	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding	Favorable	Favorable.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
PuB Purves	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slow intake, depth to rock.	Depth to rock	Depth to rock.
PuC Purves	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slow intake, depth to rock, slope.	Depth to rock	Depth to rock.
RaB Rader	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
RdB:* Rader	Slight	Moderate: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
Urban land.						
SaB Sanger	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
SaC Sanger	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
SbC:* Sanger	Slight	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly	Percs slowly.
Urban land.						
SeC Seawillow	Moderate: seepage.	Moderate: piping.	Deep to water	Slope	Favorable	Excess lime.
SeE Seawillow	Moderate: seepage.	Moderate: piping.	Deep to water	Slope	Slope	Slope, excess lime.
SfB Silstid	Moderate: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake.	Too sandy	Droughty.
SfD Silstid	Moderate: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, slope.	Too sandy	Droughty.
SlA, SlB Slidell	Slight	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly	Percs slowly.
SuB Sunev	Moderate: seepage.	Moderate: piping.	Deep to water	Excess lime	Favorable	Excess lime.
SuC Sunev	Moderate: seepage.	Moderate: piping.	Deep to water	Slope, excess lime.	Favorable	Excess lime.
Tn Tinn	Slight	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Us.* Ustorthents						
WsA, WsB Wilson	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
WuB:* Wilson	Slight	Severe: hard to pack, wetness.	Percs slowly	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
WuB:*						
Urban land.						
Ya:*						
Yahola	Severe: seepage.	Severe: piping.	Deep to water	Flooding	Soil blowing	Favorable.
Gaddy	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

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* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AbC:*											
Aledo	0-5	Clay loam	CL	A-7, A-6, A-4	0-5	85-100	85-100	80-95	60-80	27-42	8-22
	5-12	Very gravelly clay loam, very gravelly loam.	GC, SC	A-2-4, A-2-6	5-25	35-65	30-50	25-50	15-35	27-40	8-20
	12-14	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bolar	0-12	Clay loam	CL, SC, CH	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-57	9-34
	12-36	Clay loam, loam, silty clay loam.	CL, SC, CH	A-6, A-7	0-10	75-98	75-95	65-90	40-80	25-60	11-38
	36-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
AtB Altoga	0-37	Silty clay	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	70-99	34-52	18-33
	37-62	Silty clay, silty clay loam, clay loam.	CL	A-6, A-7-6	0	95-100	95-100	90-100	58-99	34-48	18-33
BaB Bastrop	0-8	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	8-80	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
BaC Bastrop	0-16	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	40-65	18-25	2-7
	16-72	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
BmE:*											
Birome	0-6	Stony fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	5-25	75-90	75-90	55-90	30-55	<30	NP-7
	6-35	Clay, sandy clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	51-75	35-55	15-35
	35-60	Stratified weathered bedrock to shaly clay.	---	---	---	---	---	---	---	---	---
Rayex	0-4	Stony fine sandy loam.	SC, SM, SM-SC, CL-ML	A-4, A-2-4	2-20	90-100	75-100	65-100	30-55	<30	NP-10
	4-15	Clay loam, sandy clay, clay.	CL	A-6, A-7	0-10	80-100	80-100	80-100	65-90	30-45	15-30
	15-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
BoB Bolar	0-14	Clay loam	CL, SC, CH	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-57	9-34
	14-35	Clay loam, loam, silty clay loam.	CL, SC, CH	A-6, A-7	0-10	75-98	75-95	65-90	40-80	25-60	11-38
	35-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
BoC Bolar	0-14	Clay loam	CL, SC, CH	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-57	9-34
	14-31	Clay loam, loam, silty clay loam.	CL, SC, CH	A-6, A-7	0-10	75-98	75-95	65-90	40-80	25-60	11-38
	31-37	Weathered bedrock	---	---	---	---	---	---	---	---	---
BpE:*											
Bolar	0-19	Stony clay loam	CL, SC	A-6, A-7, A-4	8-20	75-90	75-90	70-85	36-65	25-42	9-25
	19-37	Clay loam, loam, silty clay loam.	CL, SC, CH	A-6, A-7	0-10	75-98	75-95	65-90	40-80	25-60	11-38
	37-40	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BpE:* Aledo	0-6	Gravelly clay loam.	CL, GC, SC	A-4, A-6, A-7	0-20	65-95	60-90	55-90	40-70	27-42	8-22
	6-18	Very gravelly clay loam, very gravelly loam.	GC, SC	A-2-4, A-2-6	5-25	35-65	30-50	25-50	15-35	27-40	8-20
	18-20	Weathered bedrock	---	---	---	---	---	---	---	---	---
BrE:* Brackett	0-14	Loam, clay loam, gravelly loam.	CL, SC, GC	A-6, A-4, A-7-6	0-3	90-100	85-100	65-94	55-84	25-43	10-26
	14-22	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
BuA Burleson	0-44	Clay	CH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-96	51-90	27-55
	44-72	Clay, silty clay	CH	A-7-6, A-7-5	0-1	95-100	80-100	75-99	70-95	51-90	30-55
BuB Burleson	0-36	Clay	CH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-96	51-90	27-55
	36-62	Clay, silty clay	CH	A-7-6, A-7-5	0-1	95-100	80-100	75-99	70-95	51-90	30-55
CaB Callisburg	0-14	Fine sandy loam	CL, ML, SM, SC	A-4	0	95-100	90-100	75-100	36-60	<25	NP-8
	14-24	Sandy clay loam, sandy clay, clay.	CL, SC	A-6, A-7	0	95-100	90-100	85-100	40-90	30-48	12-28
	24-74	Sandy clay, clay	CL	A-6, A-7	0	90-100	85-100	80-99	51-80	30-50	12-28
CoB Coving	0-31	Loamy fine sand	SM, SP-SM	A-3, A-2-4	0	95-100	95-100	90-100	8-28	<25	NP-4
	31-62	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	95-100	95-100	90-100	36-75	20-35	5-20
	62-80	Sandy clay loam, clay loam.	SC, CL	A-4, A-6	0	95-100	95-100	90-100	36-75	20-35	8-20
CrB Crosstell	0-7	Fine sandy loam	SM, ML, SC, CL	A-2-4, A-4	0	90-100	90-100	75-95	28-65	16-31	2-10
	7-41	Clay	CH, CL	A-7-6	0	80-100	80-100	75-98	51-85	42-60	25-40
	41-60	Stratified clay to weathered bedrock.	CH, CL, SC	A-7-6, A-6	0	80-100	80-98	70-96	36-88	35-55	15-35
CrD Crosstell	0-5	Fine sandy loam	SM, ML, SC, CL	A-2-4, A-4	0	90-100	90-100	75-95	28-65	16-31	2-10
	5-51	Clay	CH, CL	A-7-6	0	80-100	80-100	75-98	51-85	42-60	25-40
	51-76	Stratified clay to weathered bedrock.	CH, CL, SC	A-7-6, A-6	0	80-100	80-98	70-96	36-88	35-55	15-35
CuB Culp	0-6	Clay loam	CL	A-6	0	95-100	85-95	80-95	60-80	28-40	12-24
	6-16	Sandy clay loam, clay loam, clay.	CL, CH	A-7	0	95-100	85-95	80-95	75-95	41-55	20-30
	16-61	Sandy clay loam, clay loam, clay.	CL, CH	A-7	0	90-100	80-95	75-95	60-95	41-55	20-30
	61-72	Sandy clay loam, clay loam, clay.	CL, CH	A-7, A-6	0	90-100	80-95	70-95	51-85	30-51	15-35
DeC Decordova	0-10	Loamy fine sand	SM, SP-SM	A-2-4	0	85-100	85-100	80-98	10-30	<22	NP-4
	10-72	Fine sandy loam, loam.	SM, SM-SC	A-2-4, A-4	0	90-100	90-100	80-98	15-40	<25	NP-7
DnF Denton	0-32	Silty clay	CH, CL	A-7-6	0-10	80-100	80-100	80-100	75-95	49-70	26-45
	32-38	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-20	80-100	80-100	80-100	70-95	41-60	21-40
	38-41	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FeD2------------- Ferris	0-6	Clay-------------	CH	A-7-6	0	92-100	92-100	75-100	75-100	51-76	35-55
	6-66	Clay, silty clay	CH	A-7-6	0	92-100	92-100	75-100	72-100	51-76	35-55
FhC:*											
Ferris-----------	0-10	Clay-------------	CH	A-7-6	0	92-100	92-100	75-100	75-100	51-76	35-55
	10-60	Clay, silty clay	CH	A-7-6	0	92-100	92-100	75-100	72-100	51-76	35-55
Heiden----------	0-28	Clay-------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	51-80	32-55
	28-74	Clay, silty clay	CH, CL	A-7-6	0	90-100	90-100	75-100	70-99	50-80	32-55
Fr--------------- Frio	0-37	Silty clay-------	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	70-95	35-52	20-34
	37-60	Silty clay loam, clay loam, silty clay loam.	CL, CH	A-6, A-7	0-5	80-100	80-100	70-100	60-95	30-52	18-34
GaB-------------- Gasil	0-16	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	95-99	50-99	15-40	<20	NP-4
	16-72	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
GfB-------------- Gasil	0-8	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	8-80	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
GfC-------------- Gasil	0-9	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	9-70	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
GfD4------------- Gasil	0-7	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	7-70	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
GuD:*											
Gasil-----------	0-15	Fine sandy loam	CL, ML, SC, SM	A-4	0	95-100	95-100	85-99	36-55	20-28	3-10
	15-80	Sandy clay loam, loam, fine sandy loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	85-100	36-71	22-40	7-20
Urban land.											
Gw--------------- Gowen	0-29	Clay loam--------	CL	A-6, A-7-6	0	100	95-100	85-100	60-85	28-43	11-25
	29-60	Clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	85-100	55-85	25-43	10-25
Gy--------------- Gowen	0-38	Clay loam--------	CL	A-6, A-7-6	0	100	95-100	85-100	60-85	28-43	11-25
	38-72	Clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	85-100	55-85	25-43	10-25
HaA-------------- Hassee	0-14	Fine sandy loam	CL	A-4, A-6	0	95-100	95-100	80-100	50-80	20-35	8-16
	14-37	Clay, silty clay	CH, CL	A-7-6	0	95-100	95-100	95-100	75-95	41-60	24-40
	37-72	Clay, clay loam	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	70-95	35-52	20-35
HeB-------------- Heiden	0-80	Clay-------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	51-80	32-55
HeD-------------- Heiden	0-74	Clay-------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	51-80	32-55

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
HnB Hensley	0-5	Clay loam	CL, CL-ML	A-6, A-4	0-2	80-100	75-100	70-100	60-85	20-40	5-20
	5-16	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-95	35-55	18-35
	16-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HoA Houston Black	0-80	Clay	CH	A-7-6	0	94-100	94-100	94-100	85-100	58-98	34-72
HoB Houston Black	0-72	Clay	CH	A-7-6	0	94-100	94-100	94-100	85-100	58-98	34-72
KrB Krum	0-6	Silty clay	CH, CL	A-7-6	0	95-100	85-100	85-100	85-95	47-65	25-42
	6-52	Silty clay, clay	CH	A-7-6	0	95-100	85-100	80-100	65-95	51-74	28-50
	52-62	Silty clay loam, silty clay, clay.	CH, CL	A-7-6, A-6	0	85-100	75-100	70-99	65-95	36-60	20-39
KrC Krum	0-5	Silty clay	CH, CL	A-7-6	0	95-100	85-100	85-100	85-95	47-65	25-42
	5-42	Silty clay, clay	CH	A-7-6	0	95-100	85-100	80-100	65-95	51-74	28-50
	42-60	Silty clay loam, silty clay, clay.	CH, CL	A-7-6, A-6	0	85-100	75-100	70-99	65-95	36-60	20-39
LeB Lewisville	0-14	Silty clay	CL, CH	A-7	0	95-100	95-100	82-99	80-95	41-61	20-37
	14-28	Silty clay, clay loam, silty clay loam.	CL, CH	A-7	0	95-100	95-100	73-99	72-95	40-60	24-36
	28-60	Silty clay, clay loam, silty clay loam.	CL, CH, SC	A-6, A-7	0	80-100	65-99	56-98	41-95	30-55	12-34
LeC Lewisville	0-8	Silty clay	CL, CH	A-7	0	95-100	95-100	82-99	80-95	41-61	20-37
	8-60	Silty clay, clay loam, silty clay loam.	CL, CH	A-7	0	95-100	95-100	73-99	72-95	40-60	24-36
LlB Lindale	0-6	Clay loam	CL, SC	A-4, A-6	0	90-100	85-100	70-100	45-75	20-40	8-20
	6-35	Clay, silty clay, clay loam, silty clay loam.	CH, CL	A-7	0	75-100	70-100	60-100	51-95	40-65	18-40
	35-60	Very gravelly clay, very gravelly silty clay loam, very cobbly clay.	GC	A-6, A-7, A-2-6, A-2-7	10-30	40-59	35-50	30-50	25-48	35-65	15-45
LnB:*											
Lindale	0-6	Clay loam	CL, SC	A-4, A-6	0	90-100	85-100	70-100	45-75	20-40	8-20
	6-35	Clay, silty clay, clay loam, silty clay loam.	CH, CL	A-7	0	75-100	70-100	60-100	51-95	40-65	18-40
	35-60	Very gravelly clay, very gravelly silty clay loam, very cobbly clay.	GC	A-6, A-7, A-2-6, A-2-7	10-30	40-59	35-50	30-50	25-48	35-65	15-45
Urban land.											
LoB Lott	0-9	Silty clay	CL, CH	A-7-6	0	95-100	95-100	85-100	75-95	41-55	22-35
	9-46	Silty clay, silty clay loam, clay, clay loam.	CL, CH	A-7-6, A-6	0	95-100	95-100	85-100	75-95	33-52	18-35
	46-62	Marl, silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0-5	90-100	90-100	85-100	75-95	21-39	6-21
LuB Luckenbach	0-13	Clay loam	CL	A-6	0-3	95-100	95-100	75-95	55-65	29-40	14-25
	13-48	Clay loam, clay	CL, CH	A-7	0-3	90-100	80-100	80-100	60-85	40-55	22-35
	48-62	Clay loam, clay	CL, SC, GC	A-6, A-7	0-5	70-100	60-95	45-95	36-80	35-45	20-30
MeE Medlin	0-60	Clay	CH, CL	A-7-6	0	90-100	85-100	85-100	80-95	48-70	25-45

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MnB Minwells	0-7	Fine sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	90-100	85-100	60-90	36-60	18-30	5-15
	7-48	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0	90-100	85-100	80-100	51-95	43-58	21-35
	48-62	Very gravelly sand, very gravelly sandy loam, gravelly sandy clay loam.	SC, GM, SP-SM, GP-GM	A-1, A-2	0-5	15-75	10-60	5-50	5-30	<44	NP-28
MnC2 Minwells	0-5	Fine sandy loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0	90-100	85-100	60-90	36-60	18-30	5-15
	5-40	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0	90-100	85-100	80-100	51-95	43-58	21-35
	40-60	Clay loam, sandy clay loam, gravelly sandy clay loam.	CL, SC	A-6, A-7-6, A-2-6, A-2-7	0	75-100	70-100	55-100	30-80	32-45	15-25
NaC Navo	-5	Clay loam	CL	A-6, A-7	0	95-100	95-100	90-100	55-85	25-48	11-25
	5-62	Clay, clay loam	CL, CH	A-7-6	0	95-100	95-100	90-100	60-90	40-65	20-45
NwB:* Navo	0-6	Clay loam	CL	A-6, A-7	0	95-100	95-100	90-100	55-85	25-48	11-25
	6-62	Clay, clay loam	CL, CH	A-7-6	0	95-100	95-100	90-100	60-90	40-65	20-45
Wilson	0-7	Silty clay loam	CL	A-6, A-7-6	0	95-100	85-100	80-100	60-96	38-49	20-30
	7-57	Silty clay, clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	57-62	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
PaB Paluxy	0-46	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-100	30-60	<25	NP-7
	46-62	Very fine sandy loam, loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-100	30-60	<25	NP-7
Pb.* Pits											
PnB Ponder	0-5	Clay loam	CL	A-6	0	95-100	95-100	90-100	50-85	30-40	15-30
	5-40	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	95-100	95-100	95-100	75-95	43-65	25-45
	40-60	Silty clay loam, silt loam, clay loam.	CH, CL	A-7, A-6	0	95-100	95-100	95-100	75-95	35-58	20-42
PnC Ponder	0-5	Clay loam	CL	A-6	0	95-100	95-100	90-100	50-85	30-40	15-30
	5-50	Clay, silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	95-100	95-100	95-100	75-95	43-65	25-45
	50-62	Silty clay loam, silt loam, clay loam.	CH, CL	A-7, A-6	0	95-100	95-100	95-100	75-95	35-58	20-42
PoB:* Ponder	0-5	Clay loam	CL	A-6	0	95-100	95-100	90-100	50-85	30-40	15-30
	5-60	Clay, silty clay, silty clay loam, clay loam.	CH, CL	A-7	0	95-100	95-100	95-100	75-95	43-65	25-45
Urban land.											

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Pp Pulexas	0-12	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	12-65	Stratified fine sandy loam to loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
Pr Pursley	0-60	Clay loam	CL	A-4, A-6, A-7-6	0	100	95-100	85-100	55-85	25-43	8-25
PuB Purves	0-7	Clay	CH	A-7-6	0-5	90-100	80-100	80-95	70-95	51-65	30-40
	7-14	Gravelly clay, very gravelly clay, gravelly clay loam.	CH, SC, GC	A-7-6	0-35	60-100	60-100	55-95	45-90	51-65	30-40
	14-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
PuC Purves	0-12	Clay	CH	A-7-6	0-5	90-100	80-100	80-95	70-95	51-65	30-40
	12-15	Gravelly clay, very gravelly clay, gravelly clay loam.	CH, SC, GC	A-7-6	0-35	60-100	60-100	55-95	45-90	51-65	30-40
	15-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RaB Rader	0-16	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	28-70	18-28	3-10
	16-27	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	27-53	Sandy clay, clay, clay loam.	CL, CH	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-38
	53-72	Sandy clay loam, sandy clay, clay.	SC, CL, CH	A-6, A-7	0	90-100	90-100	75-100	36-75	30-52	11-30
RdB:* Rader	0-16	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	28-70	18-28	3-10
	16-27	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	27-53	Sandy clay, clay, clay loam.	CL, CH	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-38
	53-72	Sandy clay loam, sandy clay, clay.	SC, CL, CH	A-6, A-7	0	90-100	90-100	75-100	36-75	30-52	11-30
Urban land.											
SaB Sanger	0-37	Clay	CH, CL	A-7-6	0	95-100	95-100	90-100	80-95	40-60	28-42
	37-60	Clay, silty clay	CH, CL	A-7-6	0	95-100	94-100	90-100	85-100	40-60	20-37
	60-80	Clay, silty clay, clay loam.	CH, CL	A-7-6, A-6	0	95-100	94-100	85-100	75-100	39-55	20-35
SaC Sanger	0-19	Clay	CH, CL	A-7-6	0	95-100	95-100	90-100	80-95	40-60	28-42
	19-49	Clay, silty clay	CH, CL	A-7-6	0	95-100	94-100	90-100	85-100	40-60	20-37
	49-62	Clay, silty clay, clay loam.	CH, CL	A-7-6, A-6	0	95-100	94-100	85-100	75-100	39-55	20-35
SbC:* Sanger	0-37	Clay	CH, CL	A-7-6	0	95-100	95-100	90-100	80-95	40-60	28-42
	37-72	Clay, silty clay	CH, CL	A-7-6	0	95-100	94-100	90-100	85-100	40-60	20-36
	72-80	Clay, silty clay, clay loam.	CH, CL	A-7-6, A-6	0	95-100	94-100	85-100	75-100	39-55	20-35
Urban land.											
SeC, SeE Seawillow	0-60	Clay loam, loam, silty clay loam.	CL	A-7-6, A-6	0-5	80-100	75-100	75-100	60-90	29-46	14-30

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SfB-------------- Silstid	0-26	Loamy fine sand	SM, SP-SM	A-2-4	0	95-100	95-100	90-100	9-25	<25	NP-3
	26-57	Sandy clay loam, loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	80-100	30-55	20-40	4-22
	57-80	Sandy clay loam, loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	85-100	70-100	22-55	20-40	4-22
SfD-------------- Silstid	0-28	Loamy fine sand	SM, SP-SM	A-2-4	0	95-100	95-100	90-100	9-25	<25	NP-3
	28-61	Sandy clay loam, loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	80-100	30-55	20-40	4-22
	61-74	Sandy clay loam, loam, fine sandy loam.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	85-100	70-100	22-55	20-40	4-22
SlA-------------- Slidell	0-52	Clay-------------	CH	A-7-6	0	95-100	95-100	95-100	85-100	51-68	28-42
	52-72	Silty clay, clay	CH, CL	A-7-6	0	95-100	93-100	85-100	73-100	40-60	20-39
SlB-------------- Slidell	0-60	Clay-------------	CH	A-7-6	0	95-100	95-100	95-100	85-100	51-68	28-42
	60-80	Silty clay, clay	CH, CL	A-7-6	0	95-100	93-100	85-100	73-100	40-60	20-39
SuB-------------- Sunev	0-16	Clay loam--------	CL, CH	A-6, A-7-6	0	90-100	80-100	80-100	60-80	30-51	12-32
	16-62	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	80-100	70-100	65-100	51-61	25-40	8-20
SuC-------------- Sunev	0-12	Clay loam--------	CL, CH	A-6, A-7-6	0	90-100	80-100	80-100	60-80	30-51	12-32
	12-62	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	80-100	70-100	65-100	51-61	25-40	8-20
Tn--------------- Tinn	0-18	Clay-------------	CH, CL	A-7	0	95-100	95-100	85-100	80-100	45-75	25-54
	18-60	Clay, silty clay	CH	A-7	0	95-100	90-100	80-100	80-100	55-75	35-54
Us.* Ustorthents											
WsA-------------- Wilson	0-7	Silty clay loam	CL	A-6, A-7-6	0	95-100	85-100	80-100	60-96	38-49	20-30
	7-50	Silty clay, clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	50-72	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
WsB-------------- Wilson	0-6	Silty clay loam	CL	A-6, A-7-6	0	95-100	85-100	80-100	60-96	38-49	20-30
	6-33	Silty clay, clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	33-72	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
WuB:* Wilson----------	0-7	Silty clay loam	CL	A-6, A-7-6	0	95-100	85-100	80-100	60-96	38-49	20-30
	7-66	Silty clay, clay, clay loam, silty clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	66-72	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
Urban land.											

See footnote at end of table.

TABLE 14.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ya:*											
Yahola----------	0-17	Fine sandy loam, loam, loamy fine sand.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	95-100	90-100	15-80	<26	NP-7
	17-38	Fine sandy loam, loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	95-100	90-100	36-85	<26	NP-7
	38-60	Stratified clay loam to loamy fine sand.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	100	95-100	90-100	15-85	<26	NP-7
Gaddy-----------	0-8	Loamy fine sand, fine sandy loam, silt loam.	SM, SM-SC, CL-ML, SP-SM	A-2, A-4	0	100	98-100	80-100	5-80	<26	NP-7
				A-3	0	100	98-100	80-100	5-35	---	NP
	8-60	Stratified fine sand to clay loam.	SM, SP-SM	A-2, A-3	0	100	98-100	80-100	5-35	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH		K	T	Pct
AbC:*										
Aledo	0-5	20-35	1.15-1.45	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	0.32	1	---
	5-12	20-35	1.20-1.50	0.6-2.0	0.05-0.12	7.9-8.4	Low	0.10		
	12-14	---	---	---	---	---	---	---		
Bolar	0-12	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.32	2	1-3
	12-36	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.17		
	36-38	---	---	---	---	---	---	---		
AtB Altoga	0-37	35-50	1.10-1.40	0.6-2.0	0.15-0.18	7.9-8.4	High	0.32	5	<2
	37-62	35-50	1.20-1.50	0.6-2.0	0.15-0.18	7.9-8.4	Moderate	0.32		
BaB Bastrop	0-8	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	Low	0.37	5	.5-1
	8-80	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	Low	0.32		
BaC Bastrop	0-16	5-20	1.50-1.65	2.0-6.0	0.11-0.17	5.6-7.3	Low	0.37	5	.5-1
	16-72	20-35	1.55-1.65	0.6-2.0	0.15-0.19	5.6-8.4	Low	0.32		
BmE:*										
Birome	0-6	10-20	1.35-1.55	0.6-2.0	0.08-0.15	5.6-7.3	Low	0.28	2	---
	6-35	35-55	1.35-1.65	0.2-0.6	0.15-0.20	3.6-6.0	Moderate	0.28		
	35-60	---	---	---	---	---	---	---		
Rayex	0-4	5-17	1.40-1.55	0.6-2.0	0.07-0.15	5.6-7.3	Low	0.20	1	---
	4-15	35-50	1.40-1.50	0.2-0.6	0.12-0.20	4.5-6.0	Moderate	0.32		
	15-40	---	---	---	---	---	---	---		
BoB Bolar	0-14	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.32	2	1-3
	14-35	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.17		
	35-40	---	---	---	---	---	---	---		
BoC Bolar	0-14	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.32	2	1-3
	14-31	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.17		
	31-37	---	---	---	---	---	---	---		
BpE:*										
Bolar	0-19	25-40	1.20-1.50	0.6-2.0	0.10-0.18	7.9-8.4	Moderate	0.20	2	---
	19-37	25-40	1.20-1.50	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	0.17		
	37-40	---	---	---	---	---	---	---		
Aledo	0-6	20-35	1.20-1.50	0.6-2.0	0.07-0.18	7.9-8.4	Moderate	0.10	1	---
	6-18	20-35	1.20-1.50	0.6-2.0	0.05-0.12	7.9-8.4	Low	0.10		
	18-20	---	---	---	---	---	---	---		
BrE:*										
Brackett	0-14	10-35	1.30-1.50	0.2-0.6	0.11-0.20	7.9-8.4	Low	0.32	2	1-3
	14-22	---	---	---	---	---	---	---		
Rock outcrop.										
BuA Burleson	0-44	35-60	1.40-1.50	<0.06	0.12-0.18	5.6-8.4	High	0.32	5	1-3
	44-72	35-60	1.40-1.50	<0.06	0.12-0.18	7.4-8.4	High	0.32		
BuB Burleson	0-36	35-60	1.40-1.50	<0.06	0.12-0.18	5.6-8.4	High	0.32	5	1-3
	36-62	35-60	1.40-1.50	<0.06	0.12-0.18	7.4-8.4	High	0.32		
CaB Callisburg	0-14	8-20	1.40-1.70	0.6-2.0	0.12-0.17	5.6-7.3	Low	0.32	5	<1
	14-24	30-50	1.40-1.70	0.2-0.6	0.14-0.20	5.1-7.3	Moderate	0.32		
	24-74	35-50	1.40-1.70	0.2-0.6	0.15-0.20	5.1-7.8	Moderate	0.32		
CoB Coving	0-31	5-12	1.50-1.60	6.0-20	0.05-0.10	6.1-7.8	Very low	0.20	5	.5-2
	31-62	18-35	1.50-1.65	0.6-2.0	0.12-0.18	5.6-7.8	Low	0.32		
	62-80	20-40	1.50-1.65	0.6-2.0	0.12-0.18	6.1-7.8	Low	0.32		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm^3	In/hr	In/in	pH				Pct
CrB	0-7	5-15	1.50-1.60	0.6-2.0	0.10-0.14	5.6-7.8	Low	0.43	3	<1
Crosstell	7-41	40-60	1.55-1.65	<0.06	0.14-0.18	4.5-8.4	High	0.37		
	41-60	40-60	1.60-1.70	<0.06	0.14-0.18	6.6-8.4	High	0.37		
CrD	0-5	5-15	1.50-1.60	0.6-2.0	0.10-0.14	5.6-7.8	Low	0.43	3	<1
Crosstell	5-51	40-60	1.55-1.65	<0.06	0.14-0.18	4.5-8.4	High	0.37		
	51-76	40-60	1.60-1.70	<0.06	0.14-0.18	6.6-8.4	High	0.37		
CuB	0-6	20-35	1.35-1.55	0.6-2.0	0.15-0.20	6.6-7.8	Moderate	0.32	5	1-3
Culp	6-16	30-50	1.35-1.60	0.2-0.6	0.12-0.18	6.6-7.8	Moderate	0.37		
	16-61	25-45	1.25-1.50	0.06-0.2	0.12-0.18	7.4-8.4	High	0.37		
	61-72	25-45	1.25-1.50	0.06-0.2	0.12-0.18	7.4-8.4	High	0.43		
DeC	0-10	5-12	1.40-1.60	2.0-6.0	0.07-0.11	5.6-7.3	Very low	0.17	5	<1
Decordova	10-72	6-17	1.40-1.65	2.0-6.0	0.10-0.16	5.6-8.4	Low	0.24		
DnB	0-32	35-60	1.35-1.55	0.06-0.2	0.15-0.20	7.9-8.4	High	0.32	2	1-4
Denton	32-38	35-60	1.40-1.60	0.06-0.2	0.15-0.20	7.9-8.4	High	0.32		
	38-41	---	---	---	---	---	---	---		
FeD2	0-6	40-65	1.40-1.50	<0.06	0.15-0.18	7.9-8.4	Very high	0.32	4	.5-2
Ferris	6-66	40-65	1.40-1.50	<0.06	0.15-0.18	7.9-8.4	Very high	0.32		
FhC:*										
Ferris	0-10	40-65	1.40-1.50	<0.06	0.15-0.18	7.9-8.4	Very high	0.32	4	.5-2
	10-60	40-65	1.40-1.50	<0.06	0.15-0.18	7.9-8.4	Very high	0.32		
Heiden	0-28	40-60	1.30-1.50	<0.06	0.15-0.20	7.9-8.4	Very high	0.32	5	1-4
	28-74	40-60	1.30-1.50	<0.06	0.12-0.20	7.9-8.4	Very high	0.32		
Fr	0-37	35-50	1.30-1.50	0.2-0.6	0.15-0.22	7.9-8.4	Moderate	0.32	5	1-4
Frio	37-60	35-50	1.35-1.60	0.2-0.6	0.11-0.22	7.9-8.4	Moderate	0.32		
GaB	0-16	5-12	1.50-1.60	6.0-20	0.07-0.11	6.1-7.8	Low	0.20	5	.5-1
Gasil	16-72	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	0.32		
GfB	0-8	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	Low	0.24	5	.5-1
Gasil	8-80	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	0.32		
GfC	0-9	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	Low	0.24	5	.5-1
Gasil	9-70	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	0.32		
GfD4	0-7	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	Low	0.24	5	.5-1
Gasil	7-70	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	0.32		
GuD:*										
Gasil	0-15	8-20	1.50-1.60	2.0-6.0	0.11-0.15	6.1-7.8	Low	0.24	5	.5-1
	15-80	15-35	1.50-1.60	0.6-2.0	0.12-0.19	5.1-6.5	Moderate	0.32		
Urban land.										
Gw	0-29	15-30	1.35-1.55	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	0.28	5	---
Gowen	29-60	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	0.28		
Gy	0-38	15-30	1.35-1.55	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	0.28	5	---
Gowen	38-72	20-35	1.40-1.60	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	0.28		
HaA	0-14	10-20	1.50-1.65	0.6-2.0	0.11-0.20	6.1-7.3	Low	0.43	5	<2
Hassee	14-37	45-60	1.55-1.70	<0.06	0.12-0.18	6.1-8.4	High	0.32		
	37-72	35-60	1.55-1.70	<0.06	0.12-0.20	6.6-8.4	High	0.32		
HeB Heiden	0-80	40-60	1.30-1.50	<0.06	0.15-0.20	7.9-8.4	Very high	0.32	5	1-4
HeD Heiden	0-74	40-60	1.30-1.50	<0.06	0.15-0.20	7.9-8.4	Very high	0.32	5	1-4

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm^3	In/hr	In/in	pH				Pct
HnB	0-5	15-30	1.30-1.50	0.2-0.6	0.12-0.20	6.1-7.8	Low	0.37	1	.5-2
Hensley	5-16	35-55	1.35-1.60	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	0.32		
	16-18	---	---	---	---	---	------------	----		
HoA Houston Black	0-80	40-60	1.30-1.50	<0.06	0.15-0.20	7.4-8.4	Very high	0.32	5	1-4
HoB Houston Black	0-72	40-60	1.30-1.50	<0.06	0.15-0.20	7.4-8.4	Very high	0.32	5	1-4
KrB	0-6	35-55	1.35-1.55	0.2-0.6	0.15-0.20	7.4-8.4	High	0.32	5	1-3
Krum	6-52	40-60	1.35-1.65	0.2-0.6	0.14-0.20	7.9-8.4	High	0.32		
	52-62	35-60	1.40-1.65	0.2-0.6	0.14-0.20	7.9-8.4	High	0.32		
KrC	0-5	35-55	1.35-1.55	0.2-0.6	0.15-0.20	7.4-8.4	High	0.32	5	1-3
Krum	5-42	40-60	1.35-1.65	0.2-0.6	0.14-0.20	7.9-8.4	High	0.32		
	42-60	35-60	1.40-1.65	0.2-0.6	0.14-0.20	7.9-8.4	High	0.32		
LeB	0-14	28-45	1.20-1.40	0.6-2.0	0.16-0.20	7.9-8.4	High	0.32	5	1-3
Lewisville	14-28	30-45	1.20-1.45	0.6-2.0	0.14-0.18	7.9-8.4	High	0.37		
	28-62	30-50	1.30-1.50	0.6-2.0	0.14-0.18	7.9-8.4	High	0.37		
LeC	0-8	28-45	1.20-1.40	0.6-2.0	0.16-0.20	7.9-8.4	High	0.32	5	1-3
Lewisville	8-60	30-45	1.20-1.45	0.6-2.0	0.14-0.18	7.9-8.4	High	0.37		
LlB	0-6	25-35	1.40-1.60	0.2-0.6	0.12-0.20	6.1-8.4	Low	0.32	2	<2
Lindale	6-35	35-50	1.40-1.60	0.06-0.2	0.10-0.20	6.1-8.4	Moderate	0.32		
	35-60	35-50	1.30-1.60	0.06-0.2	0.02-0.10	7.9-8.4	Moderate	0.28		
LnB:*										
Lindale	0-6	25-35	1.40-1.60	0.2-0.6	0.12-0.20	6.1-8.4	Low	0.32	2	<2
	6-35	35-50	1.40-1.60	0.06-0.2	0.10-0.20	6.1-8.4	Moderate	0.32		
	35-60	35-50	1.30-1.60	0.06-0.2	0.02-0.10	7.9-8.4	Moderate	0.28		
Urban land.										
LoB	0-9	35-50	1.20-1.40	0.2-0.6	0.15-0.20	7.9-8.4	High	0.32	4	1-3
Lott	9-46	35-50	1.25-1.45	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	0.32		
	46-62	16-35	1.30-1.60	0.6-2.0	0.15-0.20	7.9-8.4	Moderate	0.32		
LuB	0-13	20-35	1.35-1.55	0.6-2.0	0.15-0.18	6.1-7.8	Low	0.32	5	1-3
Luckenbach	13-48	35-55	1.35-1.60	0.2-0.6	0.13-0.18	7.4-8.4	Moderate	0.32		
	48-62	30-50	1.40-1.60	0.2-0.6	0.10-0.15	7.9-8.4	Moderate	0.28		
MeE Medlin	0-60	40-60	1.30-1.55	<0.06	0.12-0.18	7.4-8.4	High	0.32	4	.5-2
MnB	0-7	10-20	1.35-1.55	2.0-6.0	0.10-0.15	6.1-7.8	Low	0.24	5	<1
Minwells	7-48	35-45	1.35-1.60	0.06-0.2	0.12-0.18	6.1-7.3	Moderate	0.32		
	48-62	3-20	1.35-1.60	2.0-6.0	0.01-0.09	7.4-8.4	Low	0.15		
MnC2	0-5	10-20	1.35-1.55	2.0-6.0	0.10-0.15	6.1-7.8	Low	0.24	5	<1
Minwells	5-40	35-45	1.35-1.60	0.06-0.2	0.12-0.18	6.1-7.3	Moderate	0.32		
	40-60	20-35	1.35-1.60	0.2-0.6	0.10-0.18	6.6-8.4	Moderate	0.32		
NaC	0-5	25-35	1.50-1.60	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	0.37	5	<1
Navo	5-62	35-55	1.55-1.70	<0.06	0.12-0.18	5.6-8.4	High	0.32		
NwB:*										
Navo	0-6	25-35	1.50-1.60	0.06-0.2	0.15-0.20	5.6-7.3	Moderate	0.37	5	<1
	6-62	35-55	1.55-1.70	<0.06	0.12-0.18	5.6-8.4	High	0.32		
Wilson	0-7	27-40	1.40-1.65	0.2-0.6	0.15-0.20	5.6-7.3	Low	0.43	5	.5-2
	7-57	35-50	1.50-1.70	<0.06	0.14-0.20	5.6-8.4	High	0.37		
	57-62	35-60	1.50-1.70	<0.06	0.12-0.15	6.6-8.4	High	0.37		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm^3	In/hr	In/in	pH				Pct
PaB---------------	0-46	10-20	1.35-1.55	2.0-6.0	0.14-0.20	6.1-7.8	Very low-----	0.28	5	.5-1
Paluxy	46-62	10-20	1.35-1.55	2.0-6.0	0.14-0.20	7.9-8.4	Very low-----	0.28		
Pb.*										
Pits										
PnB--------------	0-5	22-35	1.40-1.60	0.2-0.6	0.15-0.20	5.6-7.3	Moderate-----	0.37	5	1-3
Ponder	5-40	35-50	1.45-1.60	0.06-0.2	0.12-0.18	5.6-8.4	High----------	0.32		
	40-60	25-40	1.50-1.70	0.2-0.6	0.15-0.20	7.9-8.4	High----------	0.32		
PnC---------------	0-5	22-35	1.40-1.60	0.2-0.6	0.15-0.20	5.6-7.3	Moderate-----	0.37	5	1-3
Ponder	5-50	35-50	1.45-1.60	0.06-0.2	0.12-0.18	5.6-8.4	High----------	0.32		
	50-62	25-40	1.50-1.70	0.2-0.6	0.15-0.20	7.9-8.4	High----------	0.32		
PoB:*										
Ponder-----------	0-5	22-35	1.40-1.60	0.2-0.6	0.15-0.20	5.6-7.3	Moderate-----	0.37	5	1-3
	5-60	35-50	1.45-1.60	0.06-0.2	0.12-0.18	5.6-8.4	High----------	0.32		
Urban land.										
Pp----------------	0-12	10-20	1.20-1.40	2.0-6.0	0.11-0.15	5.6-8.4	Low-----------	0.28	5	<2
Pulexas	12-65	8-18	1.30-1.50	2.0-6.0	0.11-0.15	5.6-8.4	Low-----------	0.28		
Pr----------------	0-60	18-35	1.20-1.40	0.6-2.0	0.15-0.20	7.4-8.4	Moderate-----	0.28	5	1-3
Pursley										
PuB---------------	0-7	35-55	1.35-1.55	0.2-0.6	0.12-0.18	7.9-8.4	High----------	0.32	1	1-3
Purves	7-14	35-55	1.35-1.55	0.2-0.6	0.08-0.18	7.9-8.4	High----------	0.32		
	14-16	---	---	---	---	---	-------------	----		
PuC---------------	0-12	35-55	1.35-1.55	0.2-0.6	0.12-0.18	7.9-8.4	High----------	0.32	1	1-3
Purves	12-15	35-55	1.35-1.55	0.2-0.6	0.08-0.18	7.9-8.4	High----------	0.32		
	15-16	---	---	---	---	---	-------------	----		
RaB---------------	0-16	5-20	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.5	Low-----------	0.32	5	.5-2
Rader	16-27	18-30	1.40-1.60	0.2-0.6	0.12-0.18	4.5-5.5	Moderate-----	0.32		
	27-53	35-50	1.45-1.70	<0.06	0.12-0.18	4.5-6.5	High----------	0.32		
	53-72	24-45	1.45-1.70	0.06-0.2	0.12-0.18	4.5-8.4	Moderate-----	0.32		
RdB:*										
Rader------------	0-16	5-20	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.5	Low-----------	0.32	5	.5-2
	16-27	18-30	1.40-1.60	0.2-0.6	0.12-0.18	4.5-5.5	Moderate-----	0.32		
	27-53	35-50	1.45-1.70	<0.06	0.12-0.18	4.5-6.5	High----------	0.32		
	53-72	24-45	1.45-1.70	0.06-0.2	0.12-0.18	4.5-8.4	Moderate-----	0.32		
Urban land.										
SaB---------------	0-37	40-60	1.40-1.55	<0.06	0.12-0.18	7.4-8.4	High----------	0.32	5	1-3
Sanger	37-60	40-60	1.40-1.55	<0.06	0.12-0.18	7.9-8.4	High----------	0.32		
	60-80	40-60	1.50-1.70	<0.06	0.12-0.18	7.9-8.4	High----------	0.32		
SaC---------------	0-19	40-60	1.40-1.55	<0.06	0.12-0.18	7.4-8.4	High----------	0.32	5	1-3
Sanger	19-49	40-60	1.40-1.55	<0.06	0.12-0.18	7.9-8.4	High----------	0.32		
	49-62	40-60	1.50-1.70	<0.06	0.12-0.18	7.9-8.4	High----------	0.32		
SbC:*										
Sanger-----------	0-37	40-60	1.40-1.55	<0.06	0.12-0.18	7.4-8.4	High----------	0.32	5	1-3
	37-72	40-60	1.40-1.55	<0.06	0.12-0.18	7.9-8.4	High----------	0.32		
	72-80	40-60	1.50-1.70	<0.06	0.12-0.18	7.9-8.4	High----------	0.32		
Urban land.										
SeC, SeE----------	0-60	22-40	1.40-1.55	0.6-2.0	0.12-0.20	7.9-8.4	Moderate-----	0.28	5	<1
Seawillow										

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm^3	In/hr	In/in	pH				Pct
SfB Silstid	0-26	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17	5	<1
	26-57	18-32	1.50-1.70	0.6-2.0	0.12-0.17	5.1-6.5	Low	0.24		
	57-80	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24		
SfD Silstid	0-28	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17	5	<1
	28-61	18-32	1.50-1.70	0.6-2.0	0.12-0.17	5.1-6.5	Low	0.24		
	61-74	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24		
SlA Slidell	0-52	40-60	1.35-1.55	<0.06	0.15-0.20	7.4-8.4	High	0.32	5	1-4
	52-72	40-60	1.40-1.60	<0.06	0.15-0.20	7.4-8.4	High	0.32		
SlB Slidell	0-60	40-60	1.35-1.55	<0.06	0.15-0.20	7.4-8.4	High	0.32	5	1-4
	60-80	40-60	1.40-1.60	<0.06	0.15-0.20	7.4-8.4	High	0.32		
SuB Sunev	0-16	20-40	1.20-1.50	0.6-2.0	0.11-0.16	7.9-8.4	Moderate	0.28	5	1-3
	16-62	20-40	1.10-1.40	0.6-2.0	0.11-0.16	7.9-8.4	Low	0.28		
SuC Sunev	0-12	20-40	1.20-1.50	0.6-2.0	0.11-0.16	7.9-8.4	Moderate	0.28	5	1-3
	12-62	20-40	1.10-1.40	0.6-2.0	0.11-0.16	7.9-8.4	Low	0.28		
Tn Tinn	0-18	35-60	1.40-1.50	0.06-0.2	0.15-0.20	7.4-8.4	High	0.32	5	1-4
	18-60	40-60	1.40-1.50	<0.06	0.15-0.20	7.4-8.4	High	0.32		
Us.* Ustorthents										
WsA Wilson	0-7	27-40	1.40-1.65	0.2-0.6	0.15-0.20	5.6-7.3	Low	0.43	5	.5-2
	7-50	35-50	1.50-1.70	<0.06	0.14-0.20	5.6-8.4	High	0.37		
	50-72	35-60	1.50-1.70	<0.06	0.12-0.15	6.6-8.4	High	0.37		
WsB Wilson	0-6	27-40	1.40-1.65	0.2-0.6	0.15-0.20	5.6-7.3	Low	0.43	5	.5-2
	6-33	35-50	1.50-1.70	<0.06	0.14-0.20	5.6-8.4	High	0.37		
	33-72	35-60	1.50-1.70	<0.06	0.12-0.15	6.6-8.4	High	0.37		
WuB:*										
Wilson	0-7	27-40	1.40-1.65	0.2-0.6	0.15-0.20	5.6-7.3	Low	0.43	5	.5-2
	7-66	35-50	1.50-1.70	<0.06	0.14-0.20	5.6-8.4	High	0.37		
	66-72	35-60	1.50-1.70	<0.06	0.12-0.15	6.6-8.4	High	0.37		
Urban land.										
Ya:*										
Yahola	0-17	10-18	1.30-1.60	2.0-20	0.07-0.15	7.4-8.4	Low	0.20	5	.5-1
	17-38	5-18	1.40-1.70	2.0-6.0	0.11-0.20	7.9-8.4	Low	0.20		
	38-60	2-30	1.45-1.75	2.0-6.0	0.07-0.20	7.9-8.4	Low	0.20		
Gaddy	0-8	5-15	1.35-1.50	2.0-20	0.07-0.15	7.4-8.4	Low	0.17	5	<.5
	8-60	5-15	1.50-1.70	6.0-20	0.06-0.10	7.9-8.4	Low	0.17		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
AbC:*											
Aledo	C	None	---	---	>6.0	---	---	8-20	Soft	Moderate	Low.
Bolar	C	None	---	---	>6.0	---	---	20-40	Soft	High	Low.
AtB Altoga	C	None	---	---	>6.0	---	---	>60	---	High	Low.
BaB, BaC Bastrop	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
BmE:*											
Birome	C	None	---	---	>6.0	---	---	20-40	Soft	High	Moderate.
Rayex	D	None	---	---	>6.0	---	---	10-20	Soft	High	Moderate.
BoB, BoC Bolar	C	None	---	---	>6.0	---	---	20-40	Soft	High	Low.
BpE:*											
Bolar	C	None	---	---	>6.0	---	---	20-40	Soft	High	Low.
Aledo	C	None	---	---	>6.0	---	---	8-20	Soft	Moderate	Low.
BrE:*											
Brackett	C	None	---	---	>6.0	---	---	10-20	Soft	High	Low.
Rock outcrop.											
BuA, BuB Burleson	D	None	---	---	>6.0	---	---	>60	---	High	Low.
CaB Callisburg	C	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
CoB Coving	C	Rare	---	---	2.5-4.0	Perched	Nov-May	>60	---	High	Moderate.
CrB, CrD Crosstell	D	None	---	---	>6.0	---	---	>60	---	High	Moderate.
CuB Culp	C	None	---	---	>6.0	---	---	>60	---	High	Moderate.
DeC Decordova	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
DnB Denton	D	None	---	---	>6.0	---	---	22-40	Soft	High	Low.
FeD2 Ferris	D	None	---	---	>6.0	---	---	>60	---	High	Low.
FhC:*											
Ferris	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Heiden	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Fr Frio	B	Occasional	Brief	Oct-May	>6.0	---	---	>60	---	High	Low.
GaB, GfB, GfC, GfD4 Gasil	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
GuD:*											
Gasil	B	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
Urban land.											
Gw Gowen	B	Occasional	Brief	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
Gy Gowen	B	Frequent	Brief	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
HaA Hassee	D	None	---	---	1.0-2.0	Perched	May-Oct	>60	---	High	Low.
HeB, HeD Heiden	D	None	---	---	>6.0	---	---	>60	---	High	Low.
HnB Hensley	D	None	---	---	>6.0	---	---	10-20	Hard	High	Low.
HoA, HoB Houston Black	D	None	---	---	>6.0	---	---	>60	---	High	Low.
KrB, KrC Krum	D	None	---	---	>6.0	---	---	>60	---	High	Low.
LeB, LeC Lewisville	B	None	---	---	>6.0	---	---	>60	---	High	Low.
LlB Lindale	C	None	---	---	>6.0	---	---	>60	---	High	Low.
LnB:*											
Lindale	C	None	---	---	>6.0	---	---	>60	---	High	Low.
Urban land.											
LoB Lott	C	None	---	---	>6.0	---	---	>60	---	High	Low.
LuB Luckenbach	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
MeE Medlin	D	None	---	---	>6.0	---	---	>60	---	High	Low.
MnB, MnC2 Minwells	C	None	---	---	>6.0	---	---	>60	---	High	Low.
NaC Navo	D	None	---	---	>6.0	---	---	>60	---	High	Low.
NwB:*											
Navo	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Wilson	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---	High	High.
PaB Paluxy	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
Pb.* Pits											
PnB, PnC Ponder	D	None	---	---	>6.0	---	---	>60	---	High	Low.
PoB:*											
Ponder	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Urban land.											

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
Pp Pulexas	B	Frequent	Brief	Oct-May	>6.0	---	---	>60	---	Low	Low.
Pr Pursley	B	Frequent	Brief	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
PuB, PuC Purves	D	None	---	---	>6.0	---	---	8-20	Hard	High	Low.
RaB Rader	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
RdB:*											
Rader	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
Urban land.											
SaB, SaC Sanger	D	None	---	---	>6.0	---	---	>60	---	High	Low.
SbC:*											
Sanger	D	None	---	---	>6.0	---	---	>60	---	High	Low.
Urban land.											
SeC, SeE Seawillow	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
SfB, SfD Silstid	A	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
SlA, SlB Slidell	D	None	---	---	>6.0	---	---	>60	---	High	Low.
SuB, SuC Sunev	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
Tn Tinn	D	Frequent	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---	High	Low.
Us.* Ustorthents											
WsA, WsB Wilson	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---	High	High.
WuB:*											
Wilson	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---	High	High.
Urban land.											
Ya:*											
Yahola	B	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low	Low.
Gaddy	A	Occasional	Very brief	Mar-Aug	>6.0	---	---	>60	---	Low	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

READEX FICHE best copy available

TABLE 17.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution[1]									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cm^3	Pct	Pct	Pct
Aledo clay loam:[3] (THD77TX-251-1)																	
A11-------0 to 5	A-7-6(18)	CL	100	100	100	99	93	80	73	33	22	42	22	2.61	17.0	11.5	1.78
Bolar clay loam:[3] (THD77TX-251-2)																	
A11-------0 to 6	A-7-6(21)	CH	93	93	92	91	88	77	74	34	23	51	25	2.59	15.0	15.4	1.84
B21ca----12 to 24	A-6 (08)	CL	92	90	84	76	69	60	54	26	17	36	16	2.68	17.0	9.1	1.79
Crosstell fine sandy loam:[3] (THD77TX-251-3)																	
A-------- 0 to 5	A-2-4(00)	SM	100	100	96	90	86	28	21	7	5	25	4	2.62	21.0	2.0	1.65
B21t----- 5 to 20	A-7-6(12)	CL	100	100	99	97	95	59	54	40	38	43	25	2.69	17.0	12.0	1.80
C--------51 to 76	A-7-6(20)	CL	100	99	98	95	93	68	63	39	34	45	32	2.69	17.0	15.8	2.02
Gasil loamy fine sand:[4] (THD77TX-251-4)																	
A------- 0 to 15	A-2-4(00)	SM	100	100	100	99	99	15	10	4	3	20	2	2.65	19.0	0.8	1.69
B22t---- 27 to 44	A-6 (02)	SC	100	100	100	99	98	39	33	27	26	33	16	2.68	19.0	7.6	1.78
Heiden clay:[3] (THD77TX-251-5)																	
A12------14 to 34	A-7-6(50)	CH	100	100	100	98	95	89	86	70	58	70	49	2.69	10.0	24.0	2.11
AC--------34 to 62	A-7-6(45)	CH	100	100	100	99	97	92	92	72	60	64	44	2.72	9.0	22.6	2.11

See footnotes at end of table.

TABLE 17.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution[1]									Liquid limit[2]	Plasticity index[2]	Specific gravity	Shrinkage		
			Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
												Pct		G/cm[3]	Pct	Pct	Pct
Houston Black clay:[5] (THD77TX-251-6)																	
A11------ 6 to 20	A-7-6(45)	CH	100	100	100	100	98	91	89	61	54	63	42	2.70	8.0	22.4	2.08
AC1------32 to 66	A-7-6(47)	CH	100	100	100	99	97	91	88	61	53	63	45	2.72	9.0	22.4	2.10
Sanger clay:[3] (THD77TX-251-7)																	
A12------ 8 to 37	A-7-6(38)	CH	100	100	100	99	97	95	90	62	53	58	35	2.70	11.0	19.8	2.03
AC1------37 to 60	A-7-6(36)	CH	100	100	100	96	92	89	88	62	50	56	37	2.72	12.0	19.6	2.06
C--------72 to 80	A-7-6(23)	CL	100	100	99	96	89	83	81	49	37	42	27	2.73	12.0	14.3	2.01
Silstid loamy fine sand:[3] (THD77TX-251-8)																	
A1------- 0 to 14	A-2-4(00)	SP-SM	100	100	100	100	100	9	9	2	2	24	3	2.63	20.0	0.0	1.64
B22t-----39 to 57	A-2-6(01)	SC	100	100	100	100	100	33	31	24	22	30	14	2.67	19.0	5.4	1.74
Slidell clay:[3] (THD77TX-251-9)																	
A11------ 6 to 20	A-7-6(41)	CH	100	100	100	99	95	92	88	59	50	60	40	2.70	11.0	21.0	2.05
AC2------60 to 72	A-7-6(29)	CL	100	100	99	96	92	89	86	53	37	46	31	2.71	12.0	16.4	2.07
C--------72 to 80	A-7-6(24)	CL	100	100	99	98	94	90	86	51	34	41	27	2.71	11.0	14.7	2.04

---

[1] For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but these differences do not seriously affect the data.

[2] Liquid limit and plasticity index values were based on AASHTO-89 and AASHTO-90 methods, respectively, except that soil was added to water.

[3] Sample site is same as that of the series typical pedon given in "Soil series and their morphology."

[4] Sample site is an inclusion of Gasil loamy fine sand in an area of Gasil fine sandy loam. From Spur 102 in Keene, 2 miles east on U.S. Highway 67, 1.4 miles north on County Road 807, 1 mile east on County Road 703, 0.3 mile north on County Road 703, and 496 feet east of road.

[5] From Farm Road 1706 in Alvarado, 0.6 mile east on Farm Road 1807, 2.6 miles east on County Road 109, and 186 feet south of road.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aledo	Loamy-skeletal, carbonatic, thermic Lithic Haplustolls
Altoga	Fine-silty, carbonatic, thermic Typic Ustochrepts
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Birome	Fine, mixed, thermic Ultic Paleustalfs
Bolar	Fine-loamy, carbonatic, thermic Typic Calciustolls
Brackett	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
*Callisburg	Fine, mixed, thermic Udic Paleustalfs
Coving	Loamy, siliceous, thermic Aquic Arenic Paleustalfs
Crosstell	Fine, montmorillonitic, thermic Udertic Paleustalfs
Culp	Fine, mixed, thermic Vertic Argiustolls
Decordova	Coarse-loamy, siliceous, thermic Udic Paleustalfs
Denton	Fine, montmorillonitic, thermic Vertic Calciustolls
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Frio	Fine, mixed, thermic Cumulic Haplustolls
Gaddy	Sandy, mixed, thermic Typic Ustifluvents
Gasil	Fine-loamy, siliceous, thermic Ultic Paleustalfs
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Hassee	Fine, montmorillonitic, thermic Mollic Albaqualfs
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Krum	Fine, montmorillonitic, thermic Vertic Haplustolls
Lewisville	Fine-silty, mixed, thermic Typic Calciustolls
Lindale	Fine, mixed, thermic Typic Haplustalfs
Lott	Fine-silty, carbonatic, thermic Entic Haplustolls
Luckenbach	Fine, mixed, thermic Typic Argiustolls
Medlin	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Minwells	Fine, mixed, thermic Udic Paleustalfs
Navo	Fine, montmorillonitic, thermic Udertic Paleustalfs
Paluxy	Coarse-loamy, mixed, thermic Udic Ustochrepts
Ponder	Fine, montmorillonitic, thermic Vertic Haplustalfs
Pulexas	Coarse-loamy, mixed, nonacid, thermic Typic Ustifluvents
Pursley	Fine-loamy, mixed, thermic Fluventic Haplustolls
Purves	Clayey, montmorillonitic, thermic Lithic Calciustolls
*Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Rayex	Clayey, mixed, thermic, shallow Ultic Haplustalfs
Sanger	Fine, montmorillonitic, thermic Udic Chromusterts
Seawillow	Fine-loamy, carbonatic, thermic Typic Ustochrepts
Silstid	Loamy, siliceous, thermic Arenic Paleustalfs
Slidell	Fine, montmorillonitic, thermic Udic Pellusterts
Sunev	Fine-loamy, carbonatic, thermic Typic Calciustolls
Tinn	Fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents

*Taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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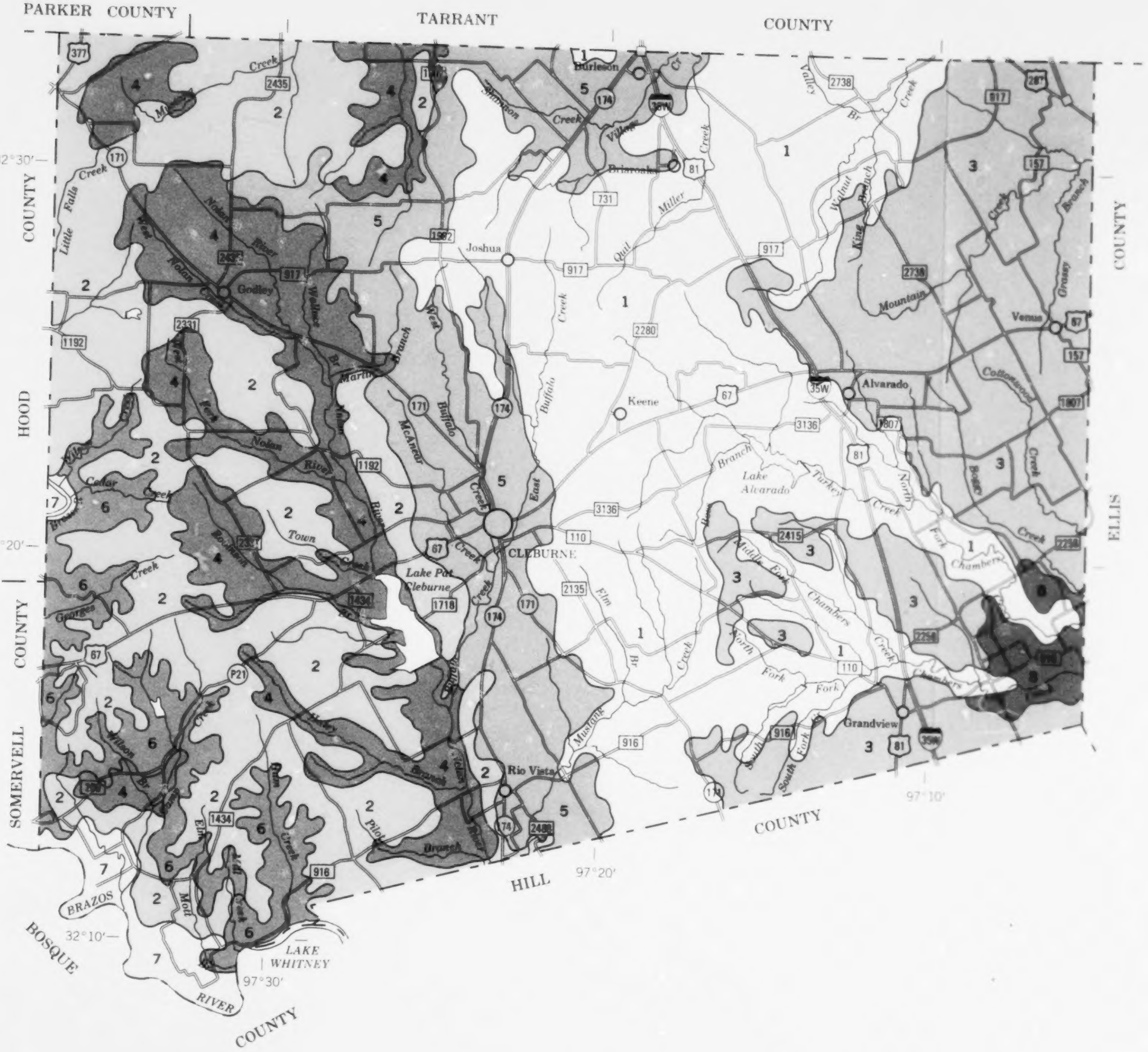

PARKER COUNTY
TARRANT COUNTY
ELLIS COUNTY
HILL COUNTY
BOSQUE COUNTY
SOMERVELL COUNTY
HOOD COUNTY
BRAZOS RIVER
LAKE WHITNEY
Burleson
Briaroaks
Joshua
Godley
Keene
Alvarado
Venus
CLEBURNE
Lake Pat Cleburne
Lake Alvarado
Rio Vista
Grandview
32°30′
32°20′
32°10′
97°30′
97°20′
97°10′

utlined on this map consists of ne kind of soil. The map is thus eneral planning rather than a basis s on the use of specific tracts.

LEGEND

1 **CROSSTELL-GASIL-RADER:** Nearly level to sloping, deep, slightly acid loamy and sandy soils; on uplands

2 **ALEDO-BOLAR:** Gently sloping to strongly sloping, very shallow to moderately deep, moderately alkaline loamy soils; on uplands

3 **HEIDEN-HOUSTON BLACK-FERRIS:** Nearly level to sloping, deep, moderately alkaline clayey soils; on uplands

4 **SANGER-SLIDELL-BOLAR:** Nearly level to sloping, moderately deep to deep, moderately alkaline clayey and loamy soils; on uplands

5 **PONDER-SANGER-SLIDELL:** Nearly level to gently sloping, deep, slightly acid to moderately alkaline loamy and clayey soils; on uplands

6 **BOLAR-BRACKETT-ALEDO:** Strongly sloping to steep, very shallow to moderately deep, moderately alkaline loamy, stony, and gravelly soils; on uplands

7 **MINWELLS-BASTROP-YAHOLA:** Nearly level to gently sloping, deep, slightly acid to moderately alkaline loamy soils; on upland terraces and the flood plain of the Brazos River

8 **BURLESON-NAVO-WILSON:** Nearly level to gently sloping, deep, slightly acid to neutral clayey and loamy soils; on uplands

*Unless otherwise indicated, the texture and reaction given in these descriptive headings refers to the surface layer of the typical pedon of the major soils.

Compiled 1982

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEXAS AGRICULTURAL EXPERIMENT STATION

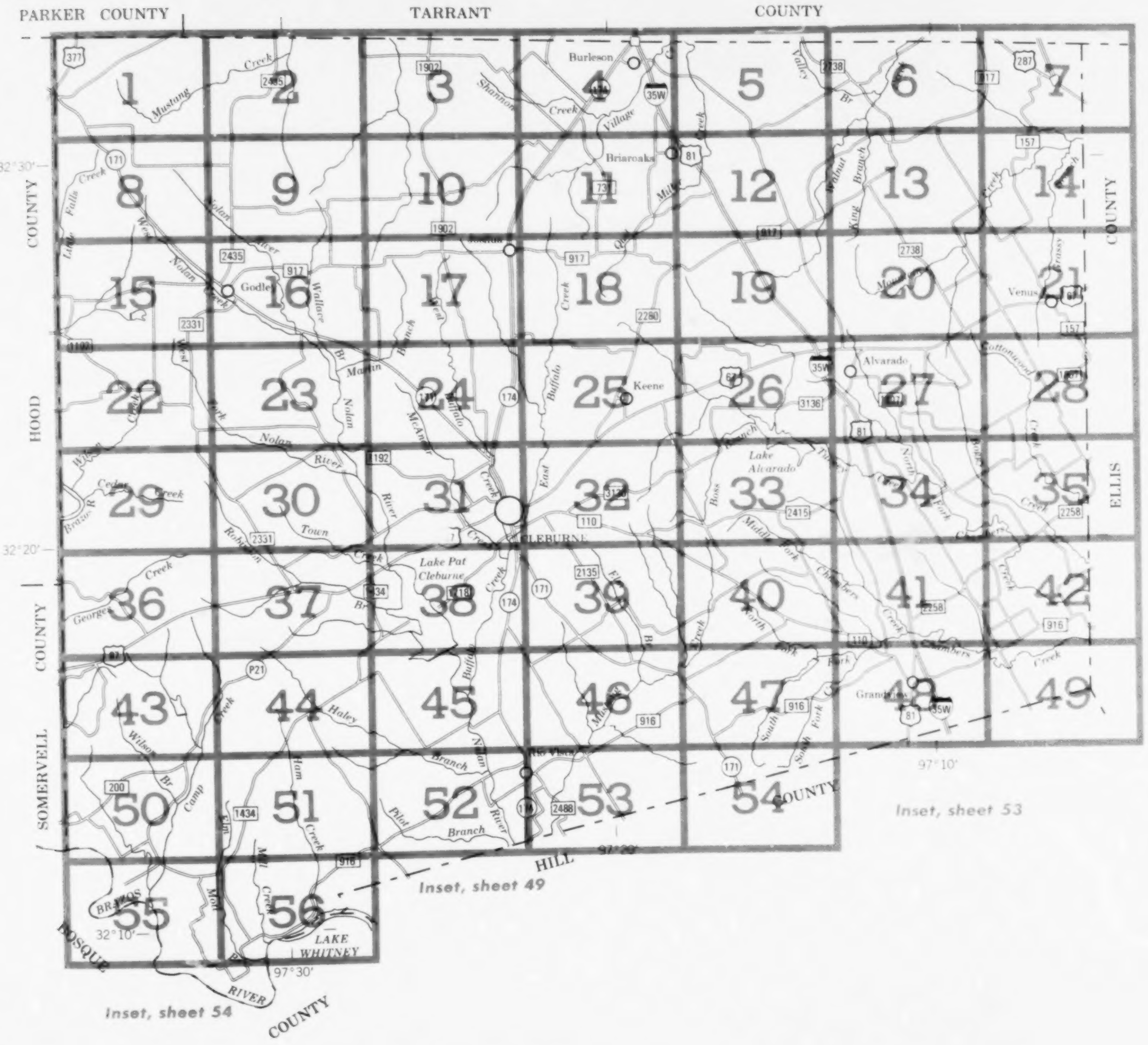
GENERAL SOIL MAP

JOHNSON COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

1 0 4 8 Km


PARKER COUNTY
TARRANT COUNTY
HOOD COUNTY
SOMERVELL COUNTY
ELLIS COUNTY
HILL COUNTY
BOSQUE COUNTY
BRAZOS RIVER
LAKE WHITNEY
Burleson
Briaroaks
Joshua
Godley
Keene
Alvarado
Venus
CLEBURNE
Lake Pat Cleburne
Lake Alvarado
Grandview
Rio Vista
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55
56
32°30′
32°20′
32°10′
97°30′
97°20′
97°10′
Inset, sheet 49
Inset, sheet 53
Inset, sheet 54

N

INDEX TO MAP SHEETS
JOHNSON COUNTY, TEXAS

Scale 1:253,440

1 0 1 2 3 4 Miles

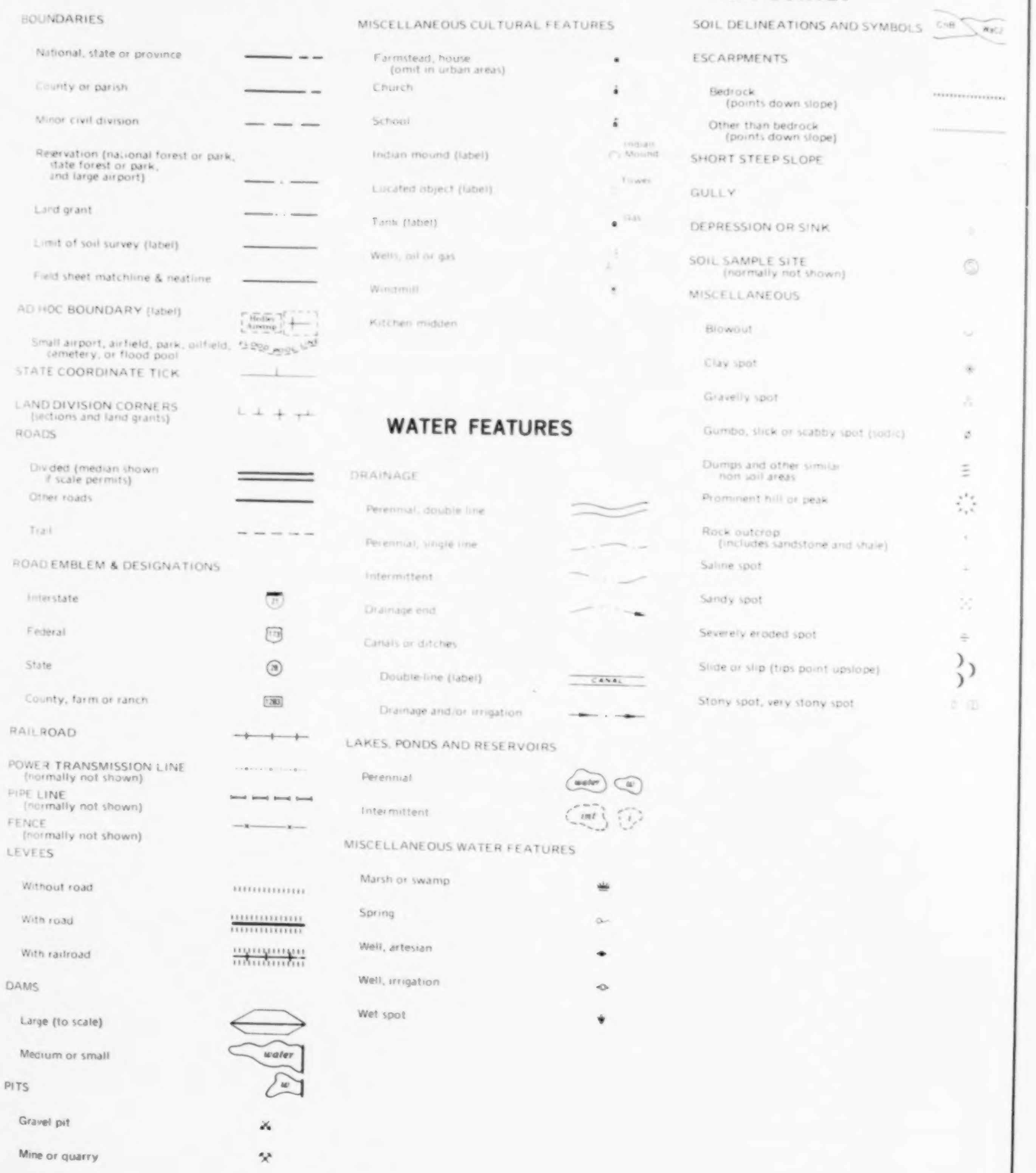
1 0 4 8 Km

SOIL LEGEND

The map symbols for publication are alphabetic letters. The first capital letter is the initial one of the soil name. The second letter is a lower case letter. The third letter is a capital letter used to show slope. Symbols without a slope letter are for nearly level soils, miscellaneous areas, or map units with names of categories above the series.

SYMBOL	NAME
AbC	Aledo-Bolar complex, 2 to 8 percent slopes
AtB	Altoga silty clay, 2 to 5 percent slopes
BaB	Bastrop fine sandy loam, 0 to 3 percent slopes
BaC	Bastrop fine sandy loam, 3 to 5 percent slopes
BmE	Birome-Rayex complex, 5 to 20 percent slopes
BoB	Bolar clay loam, 1 to 3 percent slopes
BoC	Bolar clay loam, 3 to 8 percent slopes
BpE	Bolar-Aledo complex, 8 to 20 percent slopes
BrE	Brackett-Rock outcrop complex, steep
BuA	Burleson clay, 0 to 1 percent slopes
BuB	Burleson clay, 1 to 3 percent slopes
CaB	Callisburg fine sandy loam, 1 to 3 percent slopes
CoB	Coving loamy fine sand, 0 to 3 percent slopes
CrB	Crosstell fine sandy loam, 1 to 3 percent slopes
CrD	Crosstell fine sandy loam, 3 to 8 percent slopes
CuB	Culp clay loam, 0 to 3 percent slopes
DeC	Decordova loamy fine sand, 0 to 5 percent slopes
DnB	Denton silty clay, 1 to 3 percent slopes
FeD2	Ferris clay, 5 to 12 percent slopes, eroded
FhC	Ferris-Heiden complex, 2 to 5 percent slopes
Fr	Frio silty clay, occasionally flooded
GaB	Gasil loamy fine sand, 0 to 5 percent slopes
GfB	Gasil fine sandy loam, 1 to 3 percent slopes
GfC	Gasil fine sandy loam, 3 to 5 percent slopes
GfD4	Gasil fine sandy loam, 1 to 8 percent slopes, gullied
GuD	Gasil-Urban land complex, 1 to 8 percent slopes
Gw	Gowen clay loam, occasionally flooded
Gy	Gowen clay loam, frequently flooded
HaA	Hassee fine sandy loam, 0 to 1 percent slopes
HeB	Heiden clay, 1 to 3 percent slopes
HeD	Heiden clay, 3 to 8 percent slopes
HnB	Hensley clay loam, 1 to 3 percent slopes
HoA	Houston Black clay, 0 to 1 percent slopes
HoB	Houston Black clay, 1 to 3 percent slopes
KrB	Krum silty clay, 1 to 3 percent slopes
KrC	Krum silty clay, 3 to 5 percent slopes
LeB	Lewisville silty clay, 1 to 3 percent slopes
LeC	Lewisville silty clay, 3 to 5 percent slopes
LlB	Lindale clay loam, 1 to 3 percent slopes
LnB	Lindale-Urban land complex, 1 to 3 percent slopes
LoB	Lott silty clay, 1 to 3 percent slopes
LuB	Luckenbach clay loam, 1 to 3 percent slopes
MeE	Medlin clay, 5 to 15 percent slopes
MnB	Minwells fine sandy loam, 1 to 3 percent slopes
MnC2	Minwells fine sandy loam, 2 to 5 percent slopes, eroded
NaC	Navo clay loam, 2 to 5 percent slopes
NwB	Navo-Wilson complex, 0 to 3 percent slopes
PaB	Paluxy very fine sandy loam, 1 to 3 percent slopes
Pb	Pits
PnB	Ponder clay loam, 1 to 3 percent slopes
PnC	Ponder clay loam, 3 to 5 percent slopes
PoB	Ponder-Urban land complex, 1 to 3 percent slopes
Pp	Pulexas fine sandy loam, frequently flooded
Pr	Pursley clay loam, frequently flooded
PuB	Purves clay, 1 to 3 percent slopes
PuC	Purves clay, 3 to 5 percent slopes
RaB	Rader fine sandy loam, 0 to 3 percent slopes
RdB	Rader-Urban land complex, 0 to 3 percent slopes
SaB	Sanger clay, 1 to 3 percent slopes
SaC	Sanger clay, 3 to 5 percent slopes
SbC	Sanger-Urban land complex, 1 to 5 percent slopes
SeC	Seawillow clay loam, 1 to 5 percent slopes
SeE	Seawillow clay loam, 5 to 12 percent slopes
SfB	Silstid loamy fine sand, 1 to 3 percent slopes
SfD	Silstid loamy fine sand, 3 to 8 percent slopes
SlA	Slidell clay, 0 to 1 percent slopes
SlB	Slidell clay, 1 to 3 percent slopes
SuB	Sunev clay loam, 1 to 3 percent slopes
SuC	Sunev clay loam, 3 to 5 percent slopes
Tn	Tinn clay, frequently flooded
Us	Usthorthents, loamy
WsA	Wilson silty clay loam, 0 to 1 percent slopes
WsB	Wilson silty clay loam, 1 to 3 percent slopes
WuB	Wilson-Urban land complex, 0 to 2 percent slopes
Ya	Yahola-Gaddy complex, occasionally flooded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND



CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate
- Federal
- State
- County, farm or ranch

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label)
- Located object (label)
- Tank (label)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial
- Intermittent

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

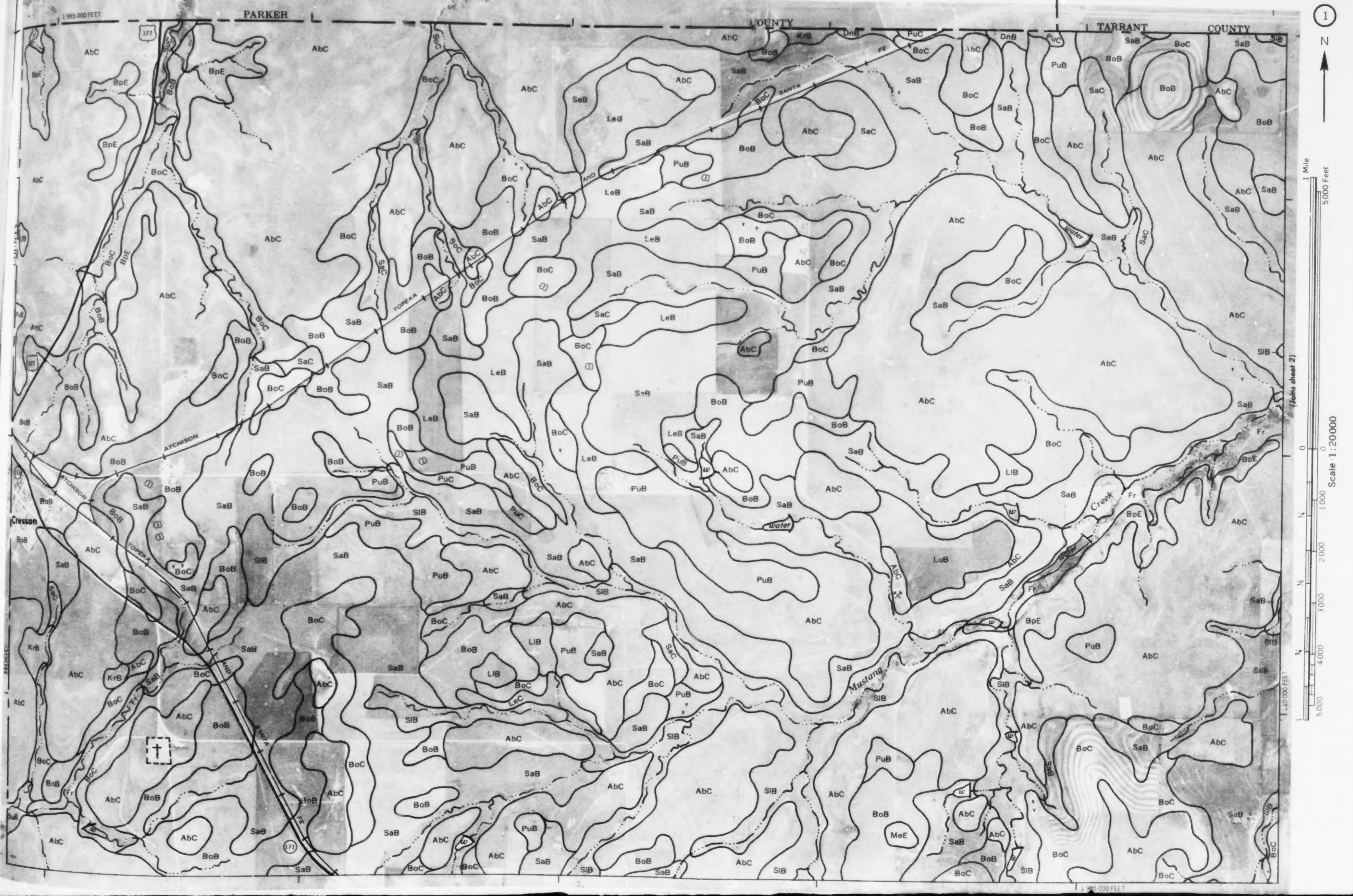
DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown)

MISCELLANEOUS

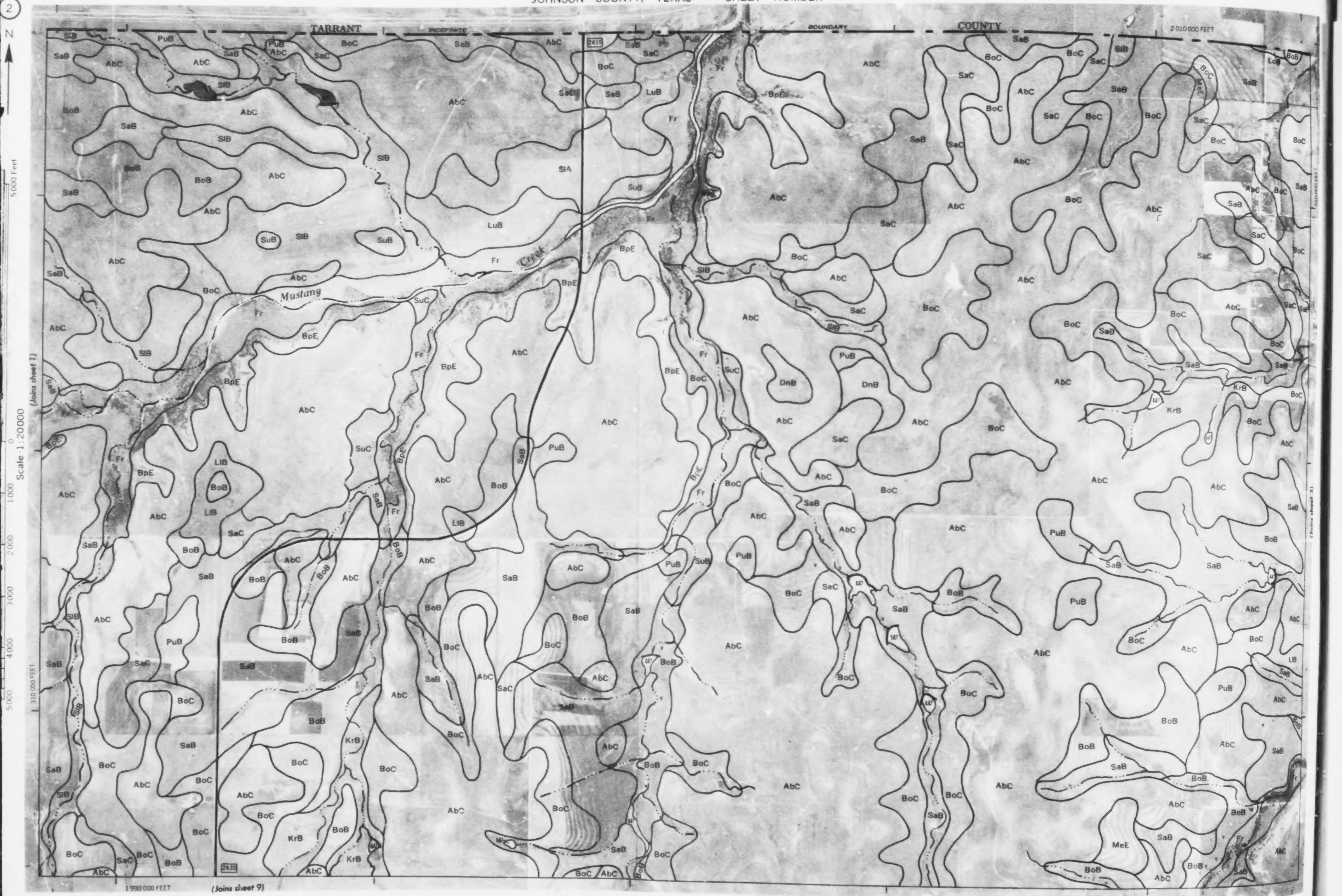
- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

JOHNSON COUNTY, TEXAS — SHEET NUMBER 1


1
N
PARKER
COUNTY
TARRANT
COUNTY
1 965 000 FEET
1 985 000 FEET
(Joins sheet 2)
ATCHISON
TOPEKA
AND
SANTA
FE
Cresson
377
171
Mustang
Creek
water
w
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
10 000 FEET
AbC
BoC
BoB
SaB
SaC
BpE
PuB
PuC
LeB
LeC
LuB
LIB
SIB
KrB
DnB
Fr
MeE

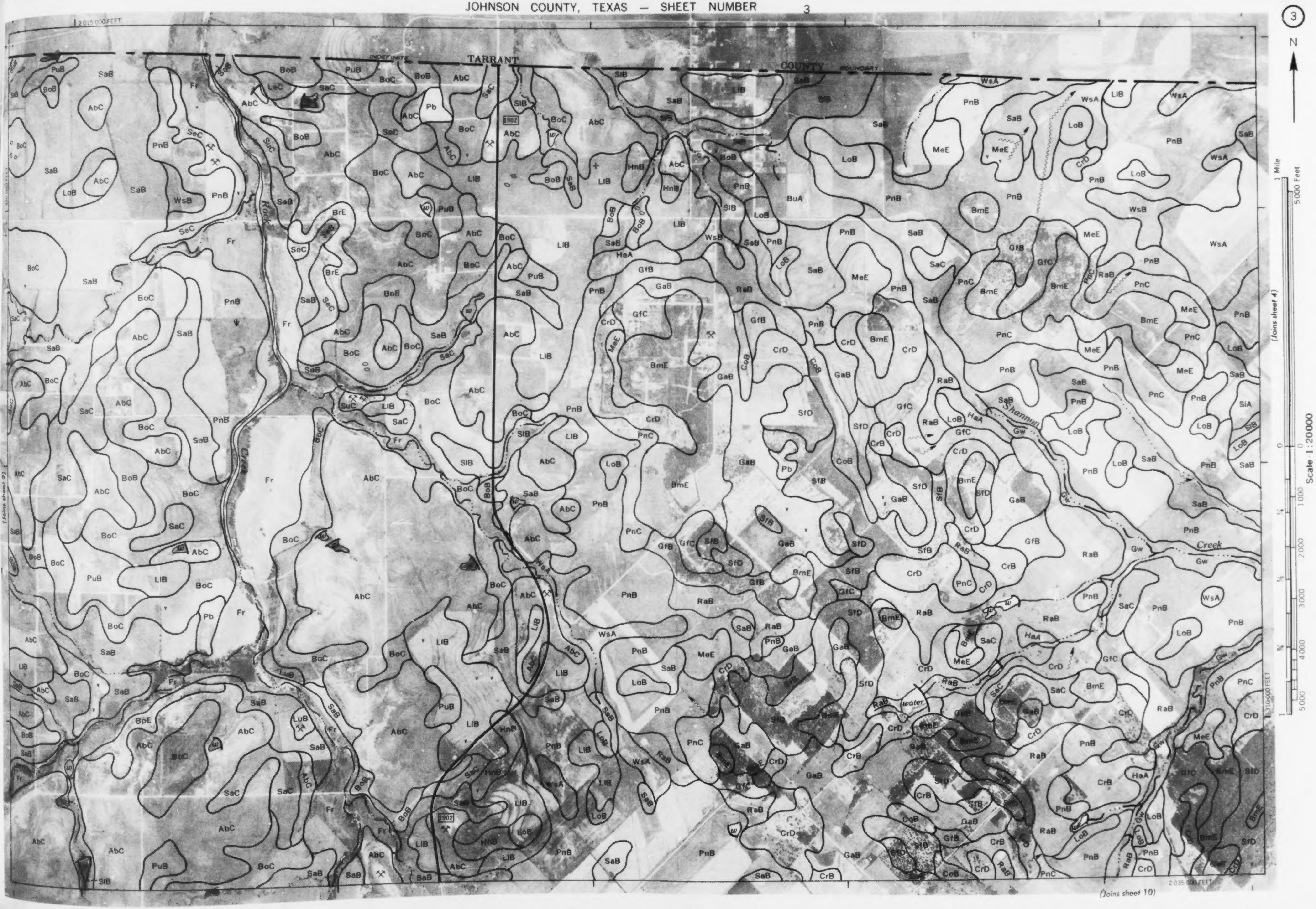
②

JOHNSON COUNTY, TEXAS — SHEET NUMBER 2


N
TARRANT
INDEFINITE
BOUNDARY
COUNTY
2 010 000 FEET
2435
Mustang
Creek
Scale 1:20000
5 000 Feet
0
1000
2000
3000
4000
5000
310 000 FEET
(Joins sheet 1)
(Joins sheet 3)
1 990 000 FEET
(Joins sheet 9)

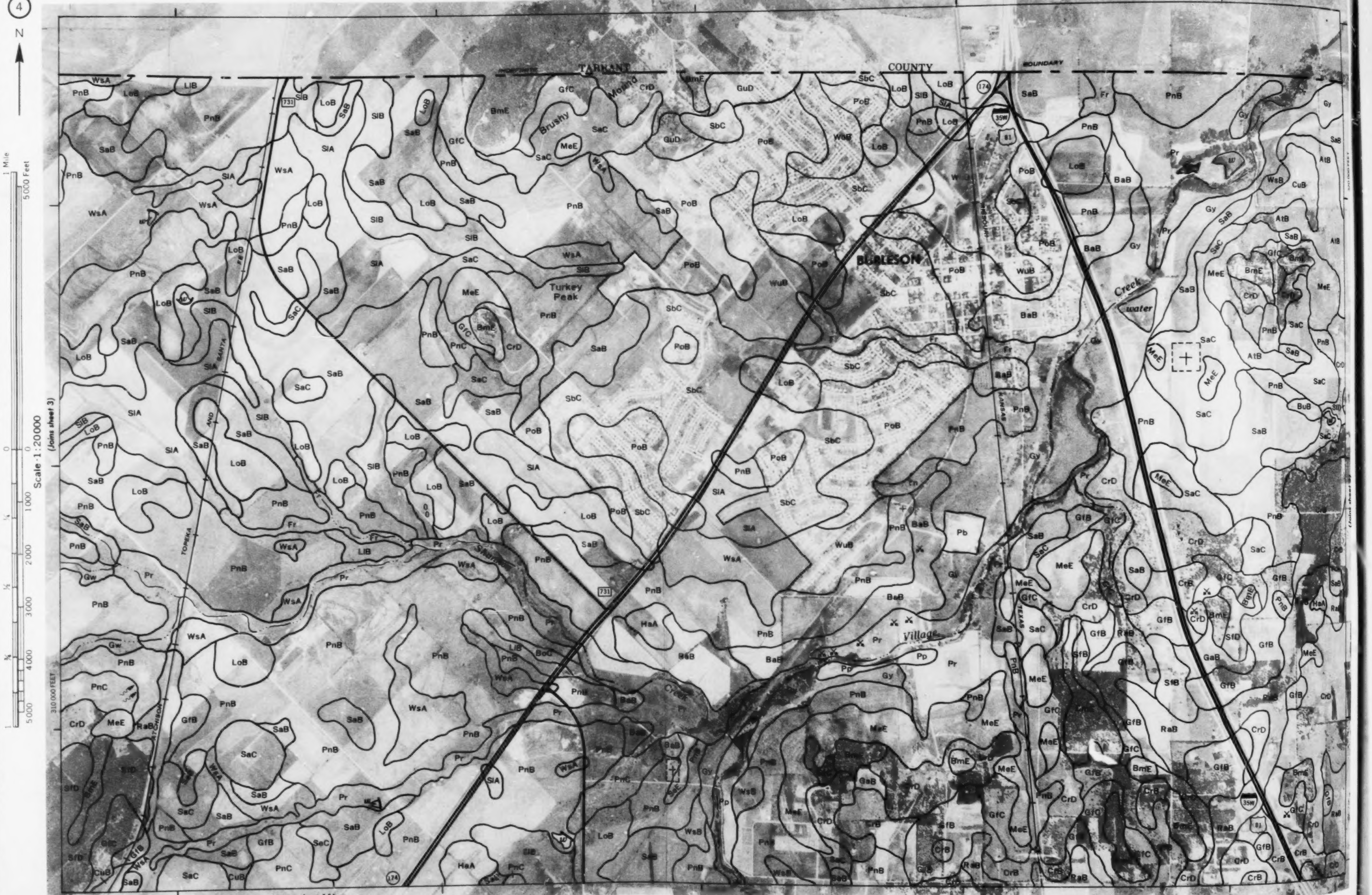
③

JOHNSON COUNTY, TEXAS — SHEET NUMBER 3

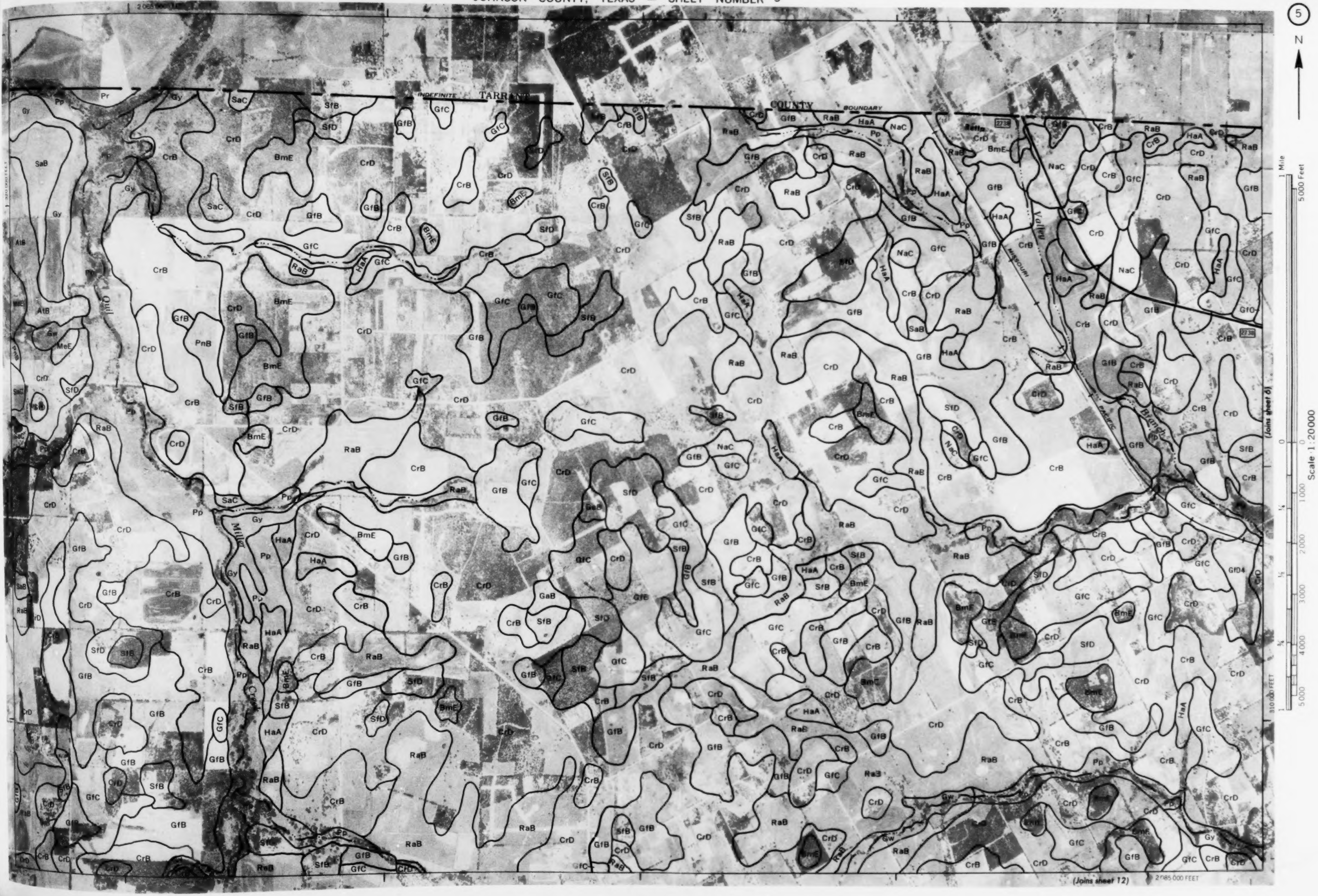

2 015 000 FEET
TARRANT
COUNTY
BOUNDARY
INDEFINITE
N
Rock
Creek
Shannon
Creek
water
1902
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 10)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
310 000 FEET
2 035 000 FEET

④

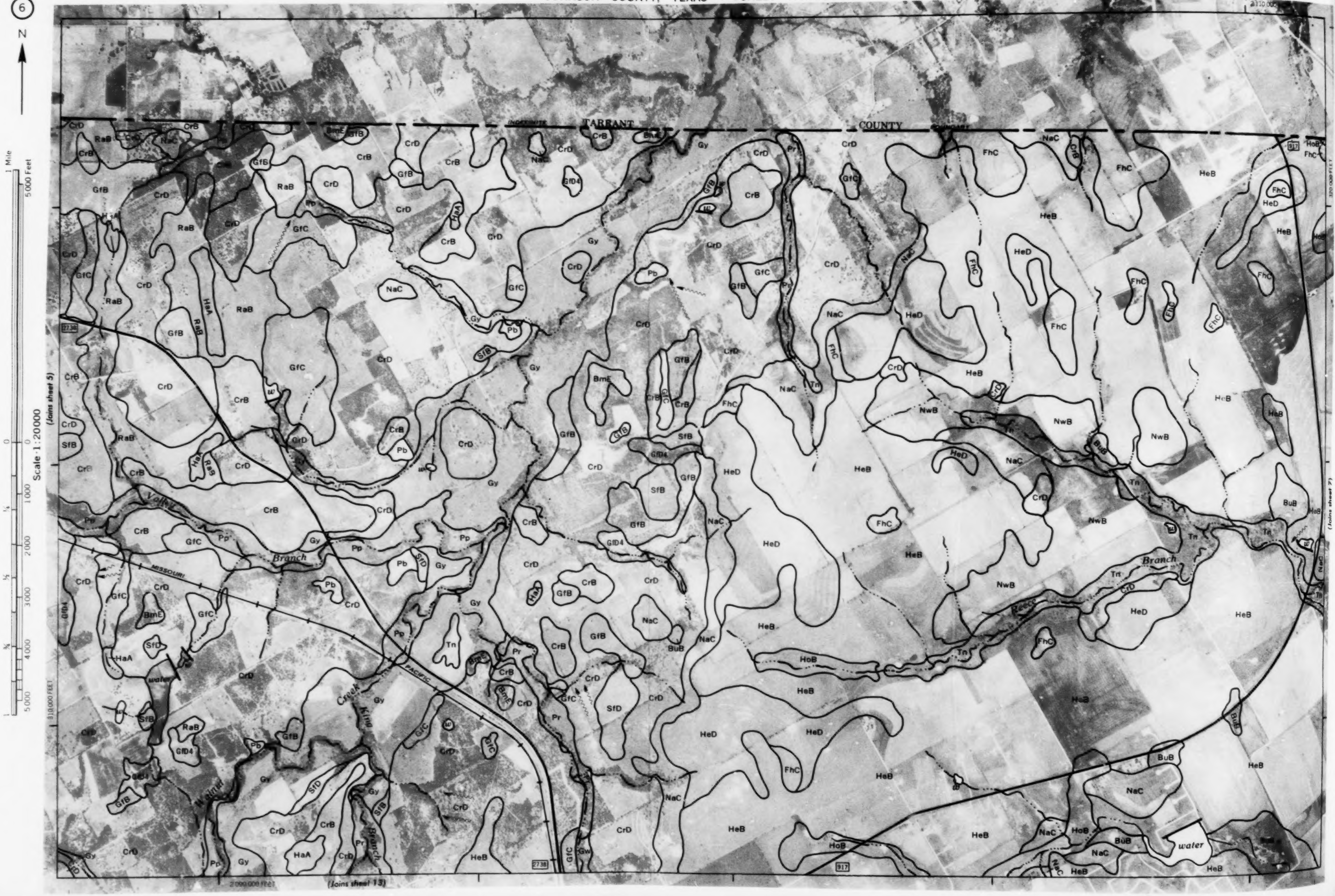
JOHNSON COUNTY, TEXAS — SHEET NUMBER 4


N
2 050 000 FEET
TARRANT COUNTY BOUNDARY
Brushy Mound
Turkey Peak
BURLESON
Creek
water
Village
Creek
TOPEKA AND SANTA FE
MISSOURI KANSAS TEXAS
(Joins sheet 3)
(Joins sheet 11)
2 040 000 FEET
310 000 FEET
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
174
731
35W
81

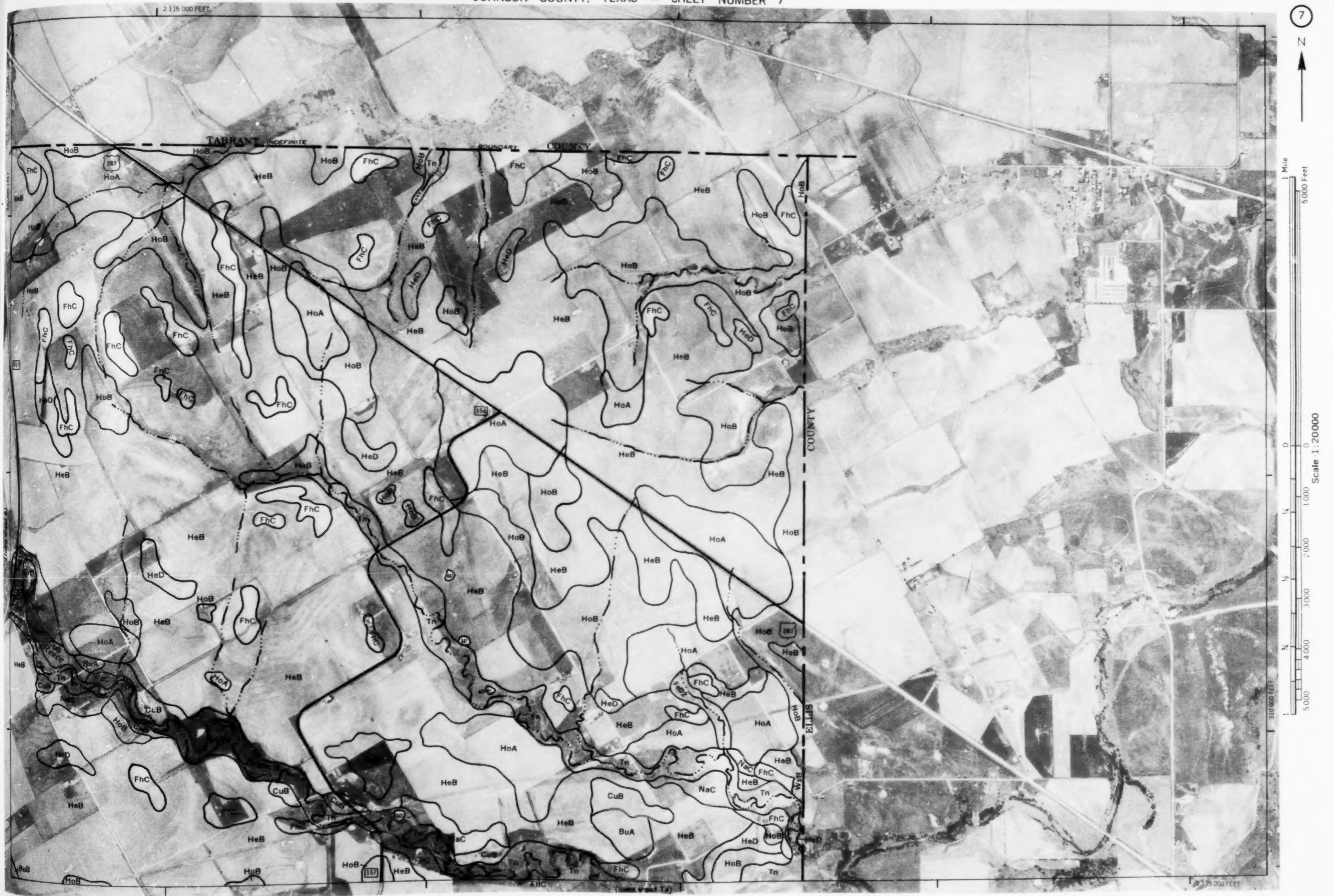
JOHNSON COUNTY, TEXAS — SHEET NUMBER 5


2 065 000 FEET
N
INDEFINITE
TARRANT
COUNTY
BOUNDARY
Quil
Miller
Creek
Valley
MISSOURI
PACIFIC
Branch
2738
1 Mile
5000 Feet
(Joins sheet 6)
Scale 1:20000
0
1000
2000
3000
4000
5000
310 000 FEET
(Joins sheet 12)
2 085 000 FEET
CrB
CrD
GfB
GfC
SfB
SfD
RaB
BmE
HaA
NaC
Pp
Gy
Gw
SaB
SaC
AtB
MeE
PnB
GaB
Pr

JOHNSON COUNTY, TEXAS — SHEET NUMBER 6

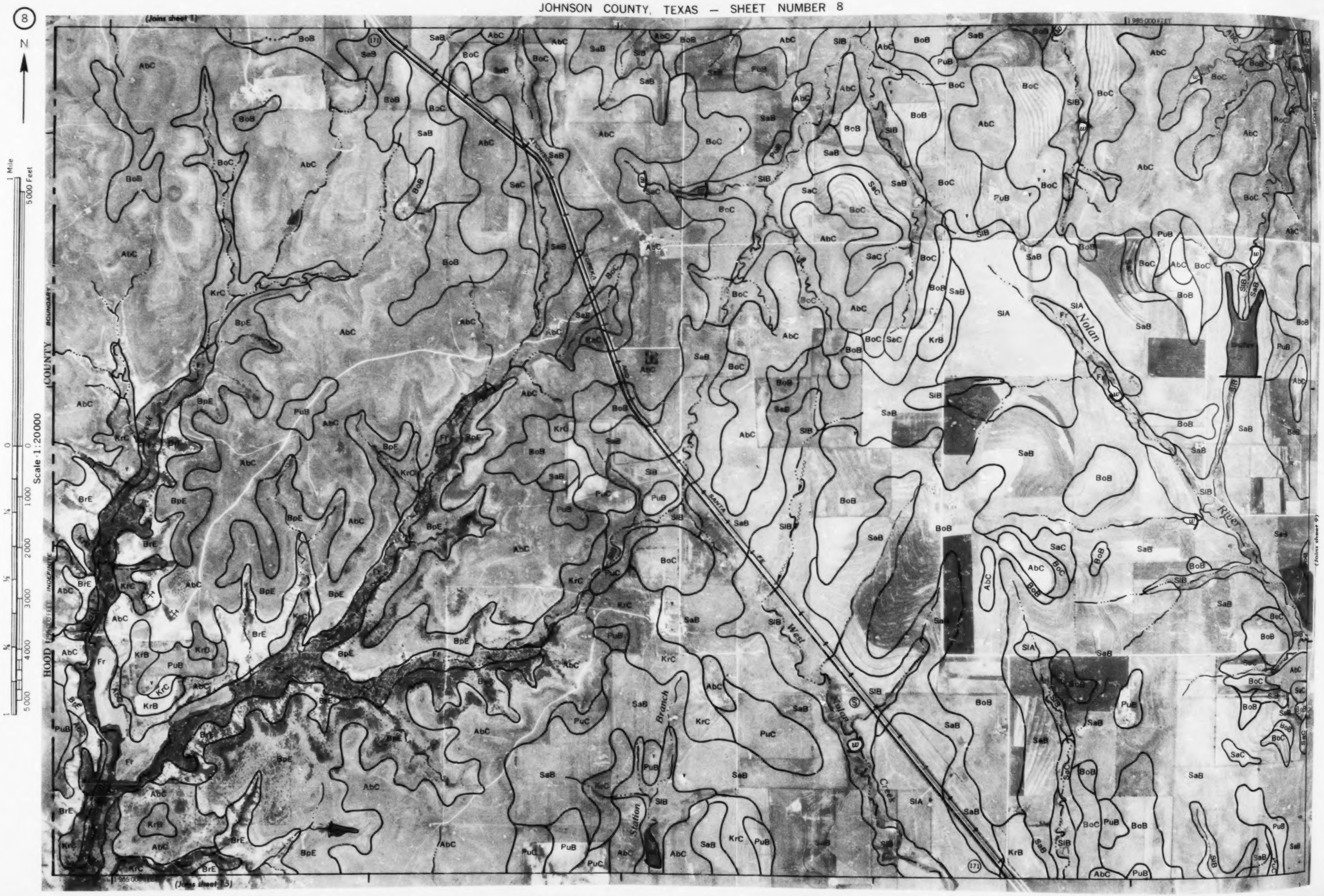

N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 13)
2 110 000 FEET
320 000 FEET
310 000 FEET
2 090 000 FEET
INDEFINITE TARRANT COUNTY BOUNDARY
Valley Branch
MISSOURI PACIFIC
Walnut Creek
King Branch
Reece Branch
water
2738
917
CrD
CrB
RaB
NaC
GfB
GfC
GfD4
BmE
HaA
Pb
Pp
Pr
Gy
Gw
SfB
SfD
Tn
FhC
HeB
HeD
HoB
NwB
BuB

JOHNSON COUNTY, TEXAS — SHEET NUMBER 7

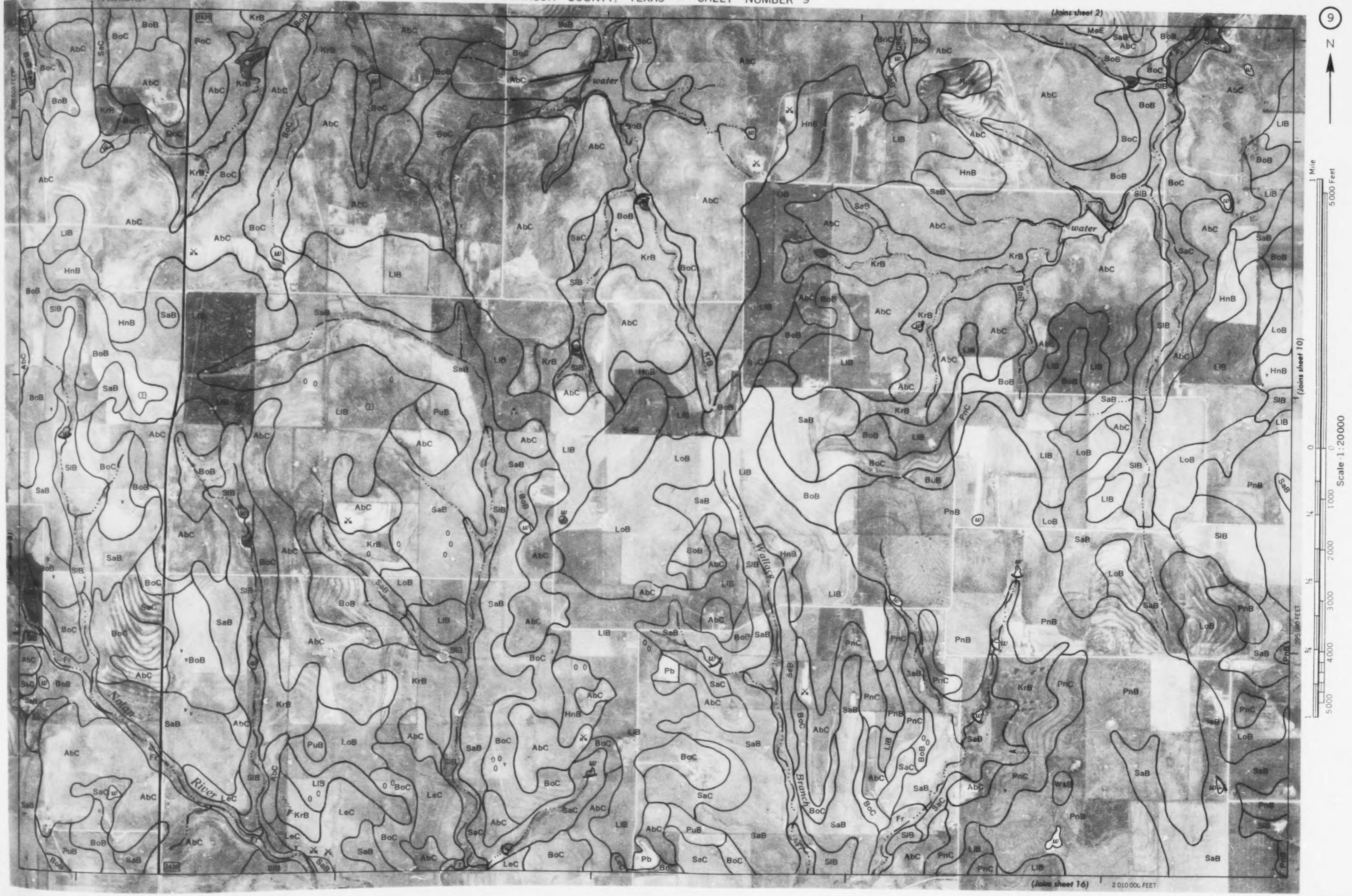

⑦
N
2 115 000 FEET
TARRANT
INDEFINITE
BOUNDARY
COUNTY
ELLIS
COUNTY
287
157
917
HoB
HoA
HeB
HeD
FhC
Tn
CuB
BuA
NaC
WeB
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
310 000 FEET
135 000 FEET
(Joins sheet 11)

⑧

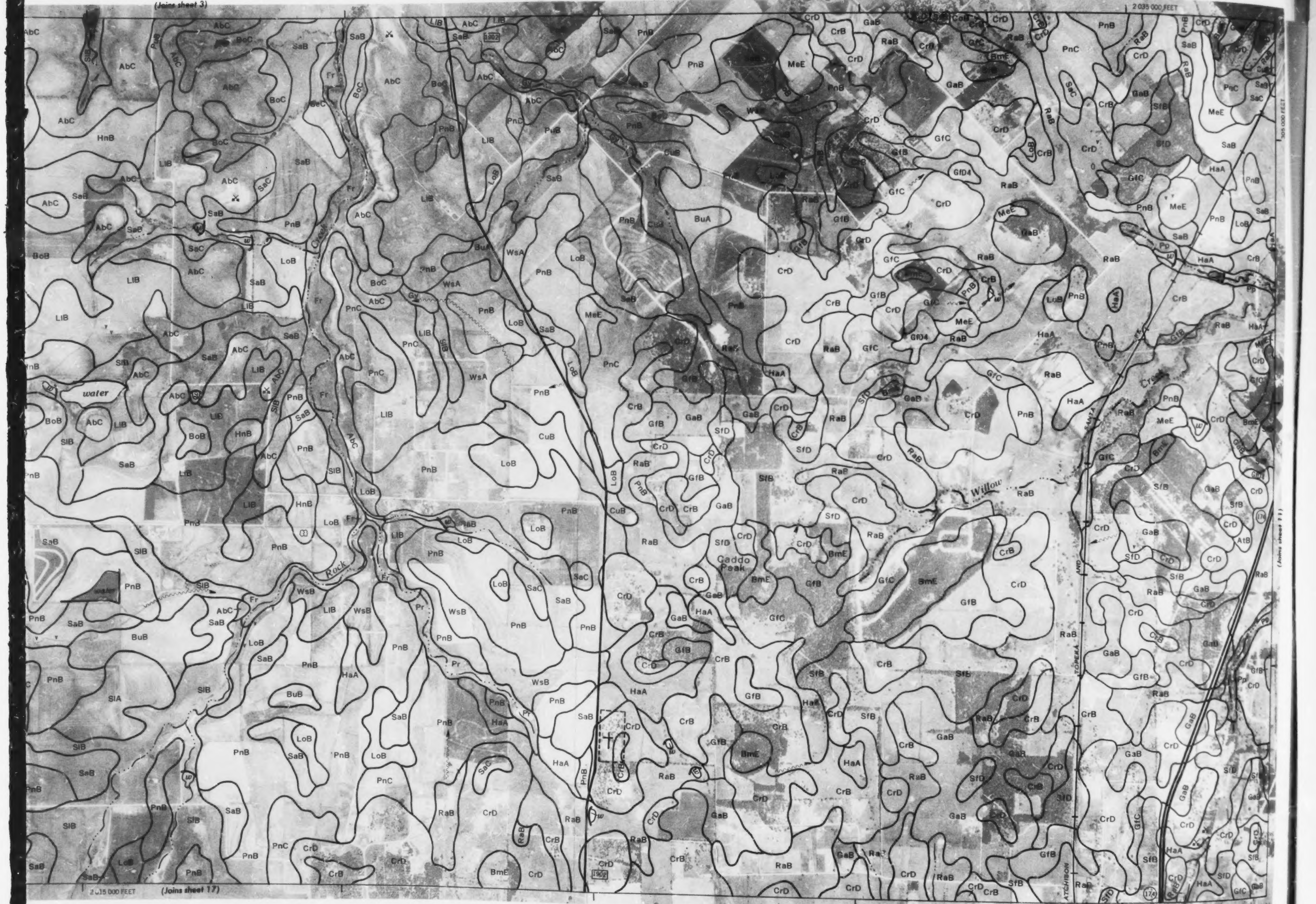
JOHNSON COUNTY, TEXAS — SHEET NUMBER 8


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
(Joins sheet 1)
(Joins sheet 15)
(Joins sheet 9)
1 985 000 FEET
HOOD COUNTY BOUNDARY
Nolan
River
West
Nolan
Creek
Station
Branch
SANTA FE
171
AbC
BoB
BoC
BpE
BrE
Fr
KrB
KrC
PuB
PuC
SaB
SaC
SlA
SlB

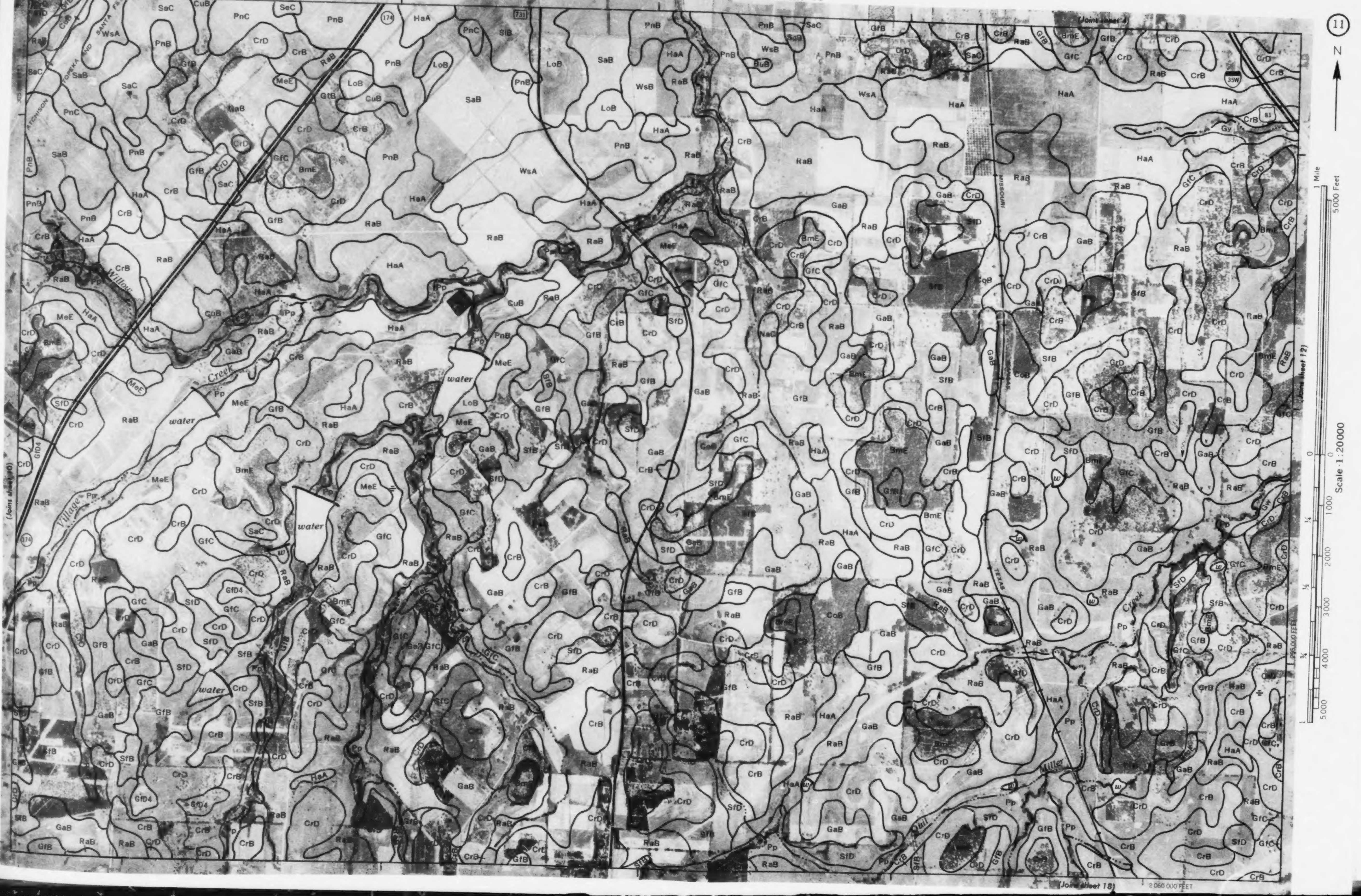
JOHNSON COUNTY, TEXAS — SHEET NUMBER 9


9
N
(Joins sheet 2)
(Joins sheet 10)
(Joins sheet 16)
1 990 000 FEET
2 010 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Nolan River
Wallace Branch
water

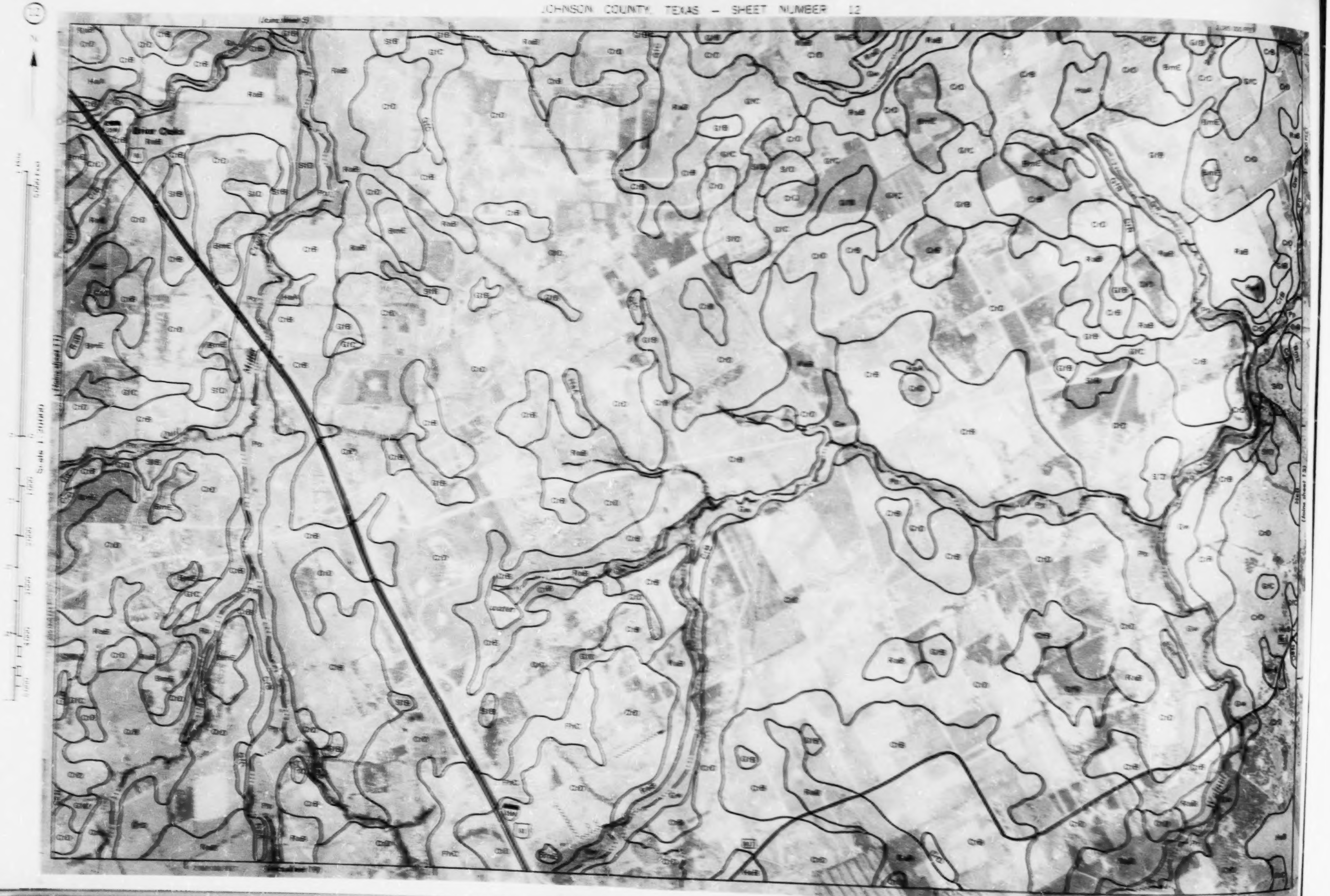
JOHNSON COUNTY, TEXAS — SHEET NUMBER 10


(Joins sheet 3)
2 035 000 FEET
(Joins sheet 17)
2 015 000 FEET
(Joins sheet 11)
Rock
Creek
Willow
Creek
Caddo Peak
water
SANTA FE
ATCHISON
TOPEKA
1902
174

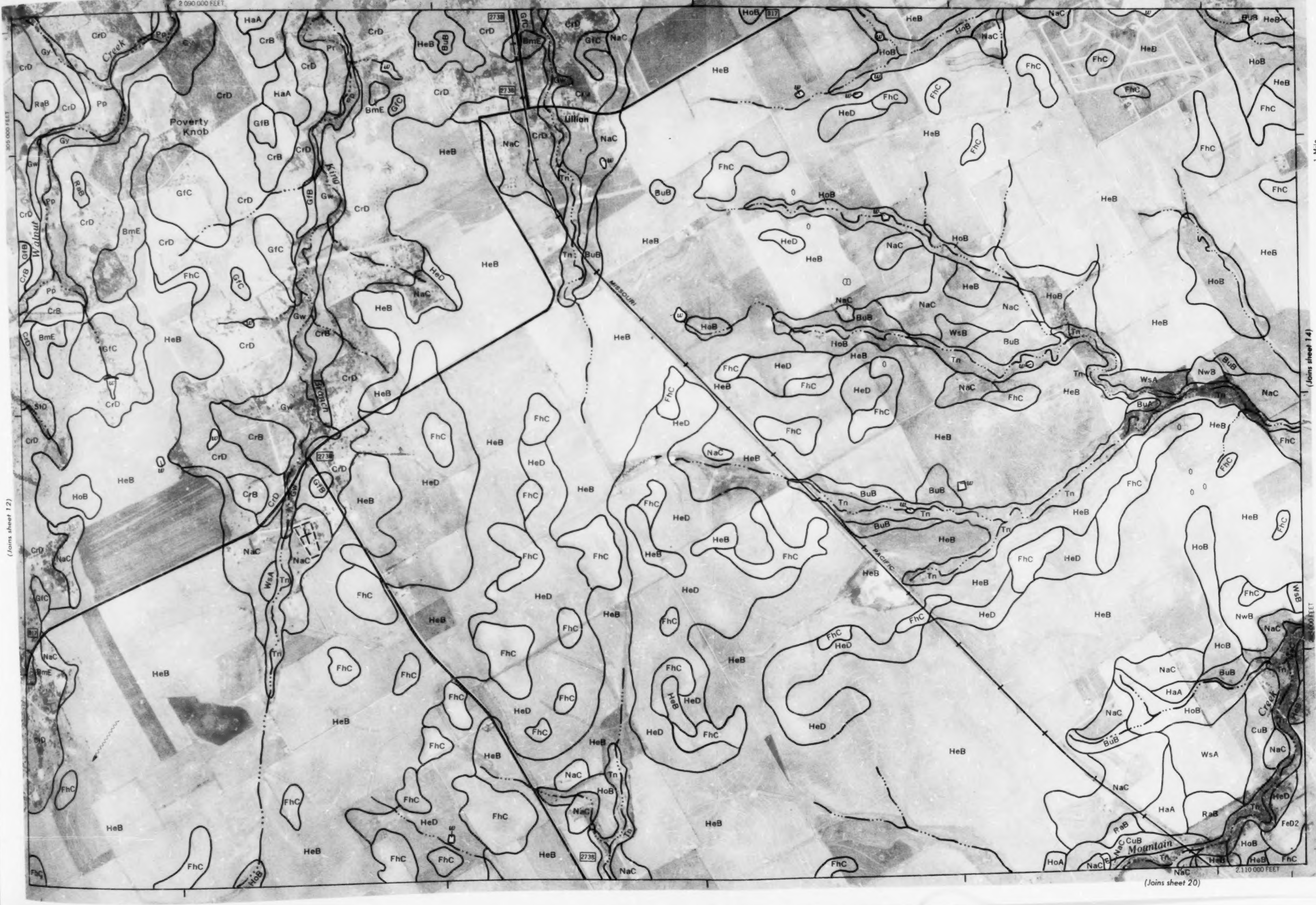
JOHNSON COUNTY, TEXAS — SHEET NUMBER 11


11
N
2 040 000 FEET
2 060 000 FEET
(Joins sheet 4)
(Joins sheet 10)
(Joins sheet 12)
(Joins sheet 18)
ATCHISON TOPEKA AND SANTA FE
MISSOURI KANSAS TEXAS
Willow Creek
Village Creek
Mill Creek
Quil Miller Creek
water
174
731
35W
81
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
SaC
PnC
PnB
CrB
CrD
RaB
HaA
SaB
WsA
WsB
LoB
GfB
GfC
BmE
MeE
CuB
GaB
SfB
SfD
Pp
GfD4
CoB
NaC
Gy
Gw
BuB

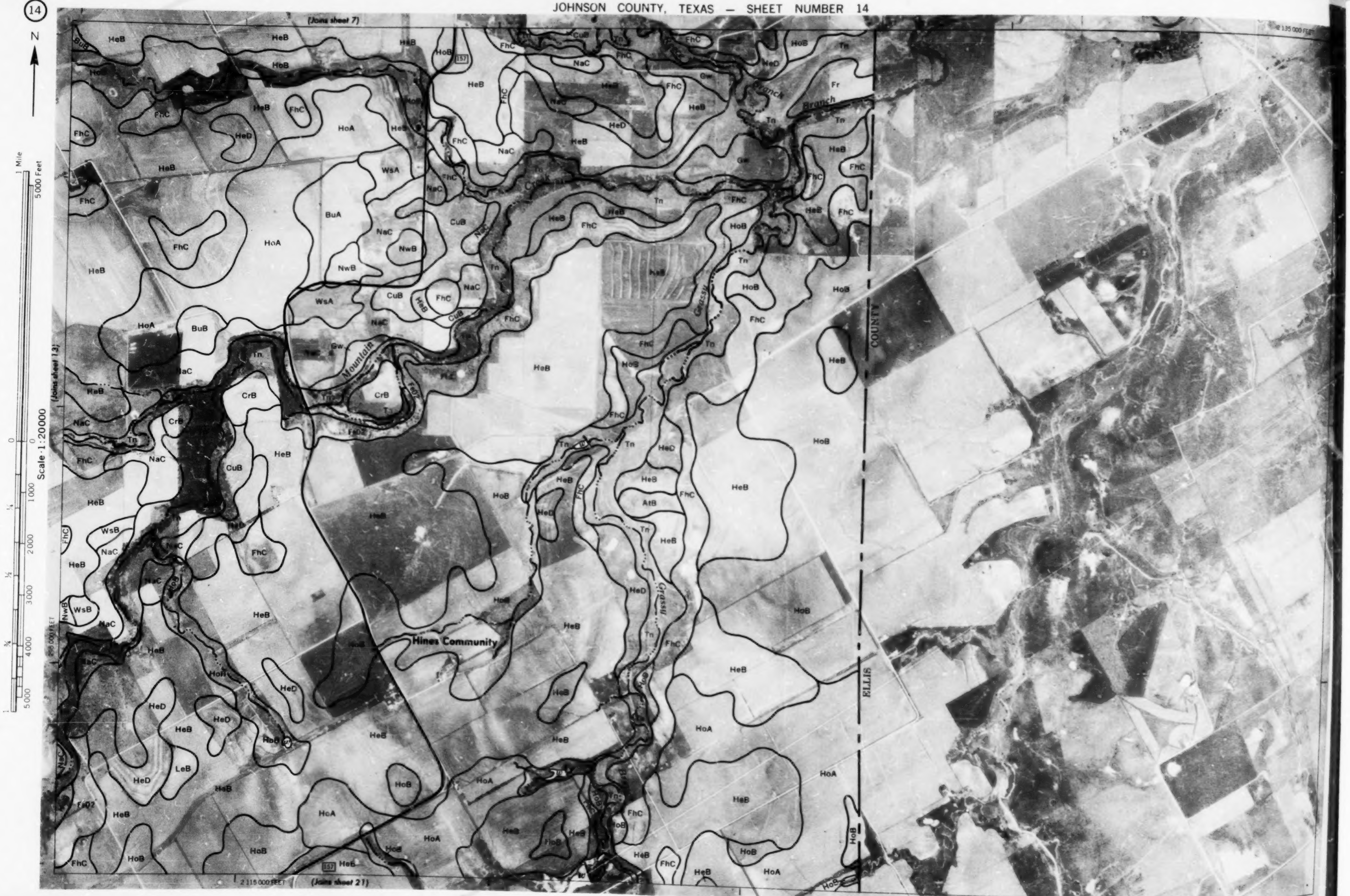
JOHNSON COUNTY, TEXAS — SHEET NUMBER 12


N
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
(Joins sheet 5)
(Joins sheet 11)
(Joins sheet 13)
Briar Oaks
RaB
CrB
CrD
GfB
GfC
BmE
SfB
SfD
Pb
Gw
HeB

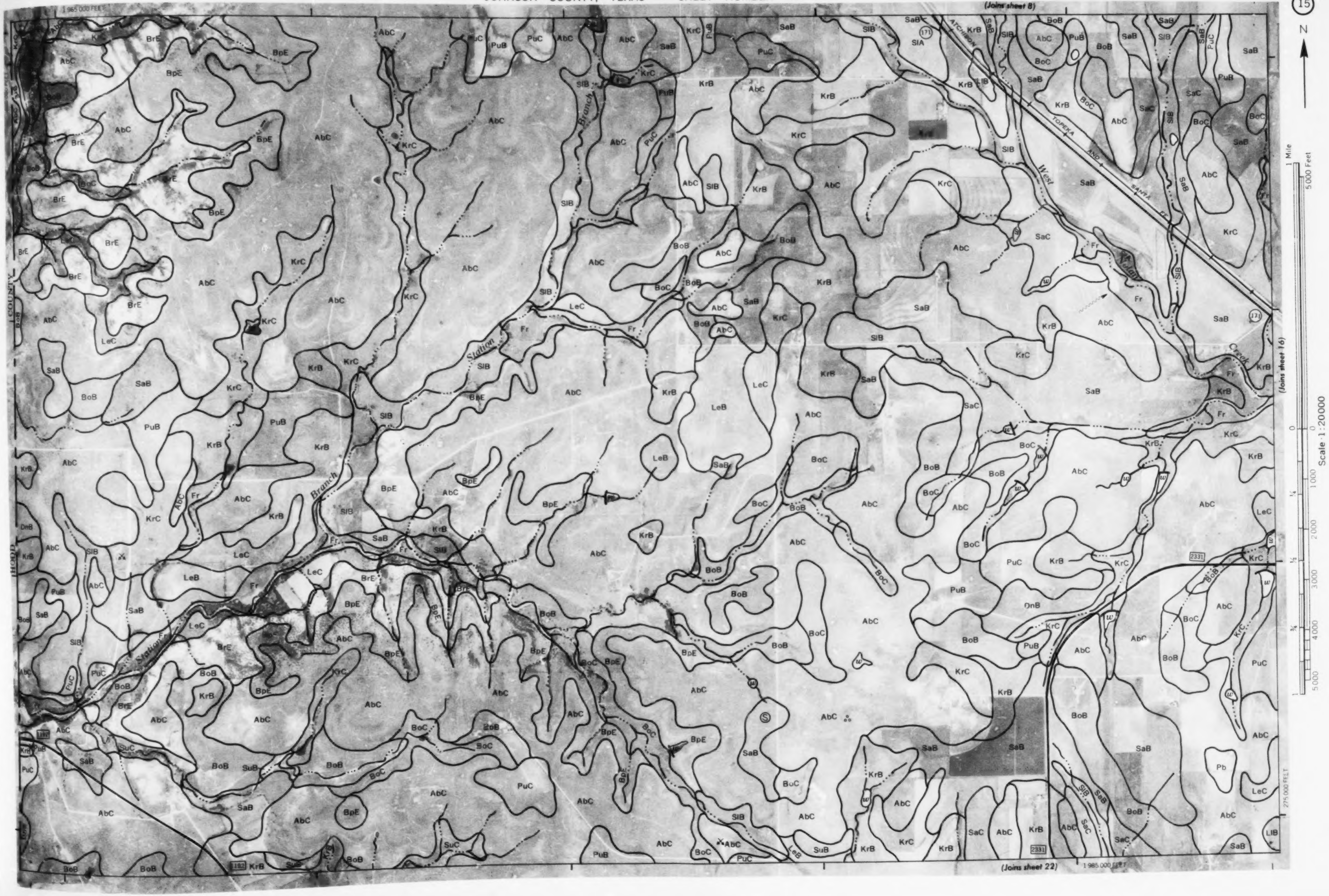
JOHNSON COUNTY, TEXAS — SHEET NUMBER 13


(Joins sheet 6)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 20)
2 090 000 FEET
2 110 000 FEET
305 000 FEET
Poverty Knob
Lillian
Walnut Creek
King Branch
Mountain Creek
MISSOURI
PACIFIC
2738
917
1 Mile
0
¼
½
¾
1
N
HeB
HeD
HoB
FhC
NaC
CrD
CrB
GfC
GfB
BmE
BuB
BuA
Tn
Gw
Gy
Pp
Pr
RaB
HaA
HoA
WsA
WsB
NwB
CuB
StD
FeD2
(w)

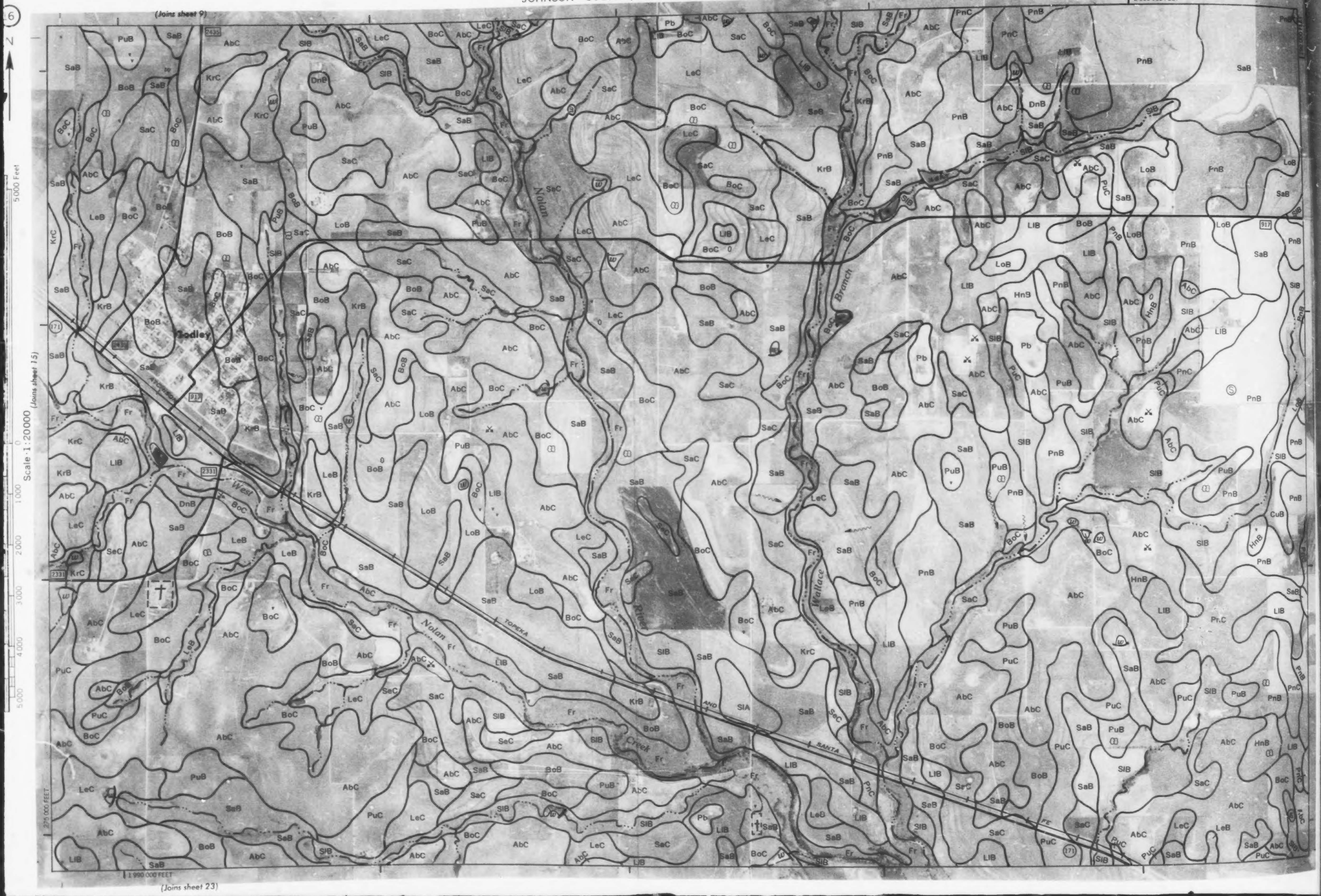
JOHNSON COUNTY, TEXAS — SHEET NUMBER 14


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 7)
(Joins sheet 13)
(Joins sheet 21)
2 135 000 FEET
2 115 000 FEET
155 000 FEET
157
Hines Community
Mountain
Creek
Grassy
Branch
ELLIS
COUNTY
HeB
HoB
HoA
FhC
NaC
Tn
Gw
CuB
CrB
BuA
BuB
WsA
WsB
NwB
HeD
AtB
LeB
FhD2
Fr

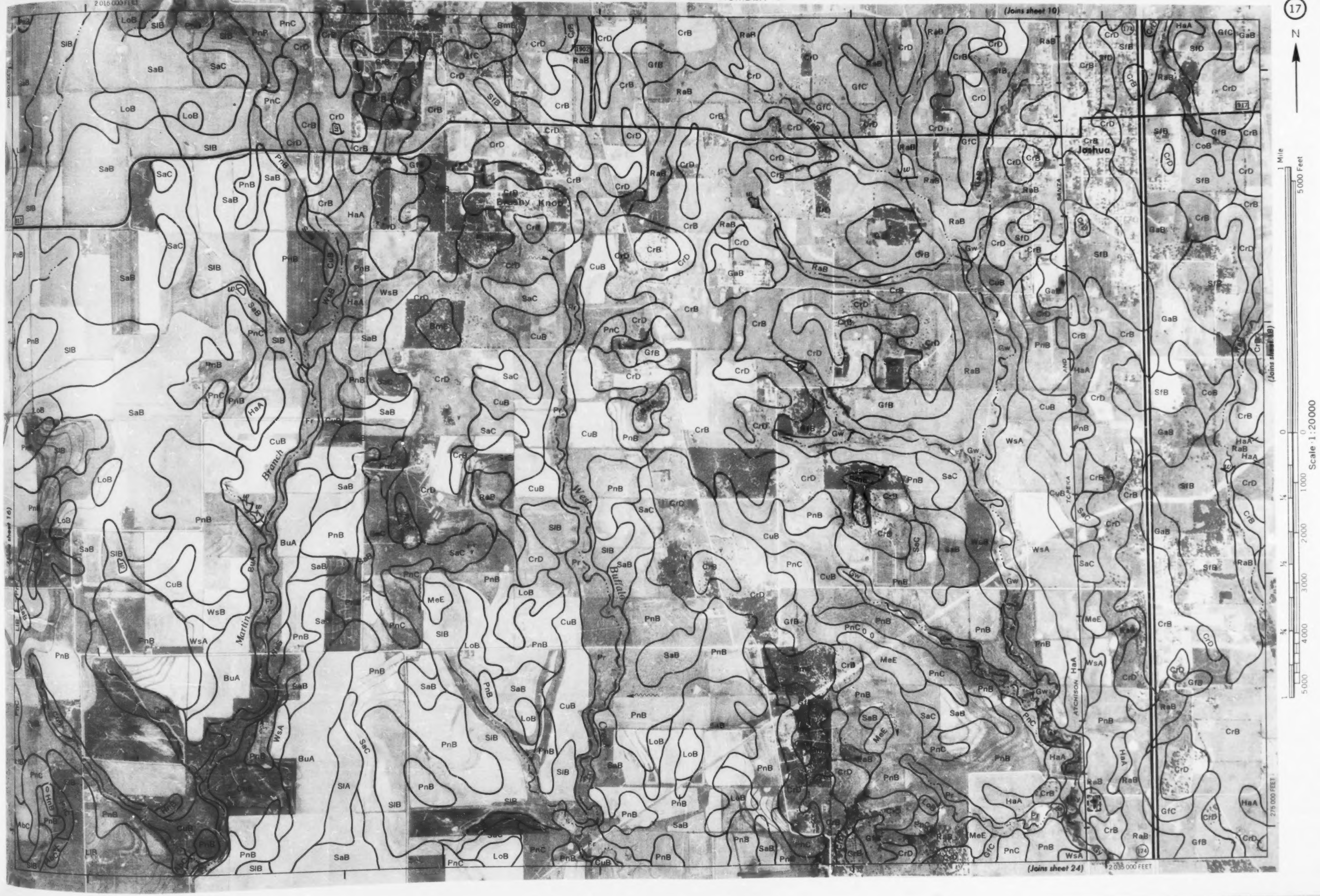
JOHNSON COUNTY, TEXAS — SHEET NUMBER 15


(Joins sheet 8)
(Joins sheet 16)
(Joins sheet 22)
1 985 000 FEET
275 000 FEET
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20000
HOOD COUNTY
Station Branch
West Creek
ATCHISON TOPEKA AND SANTA FE
171
2331
1192
AbC
BoB
BoC
BpE
BrE
DnB
Fr
KrB
KrC
LeB
LeC
LtB
Pb
PuB
PuC
SaB
SaC
SlA
SlB
SuB
SuC
w
S

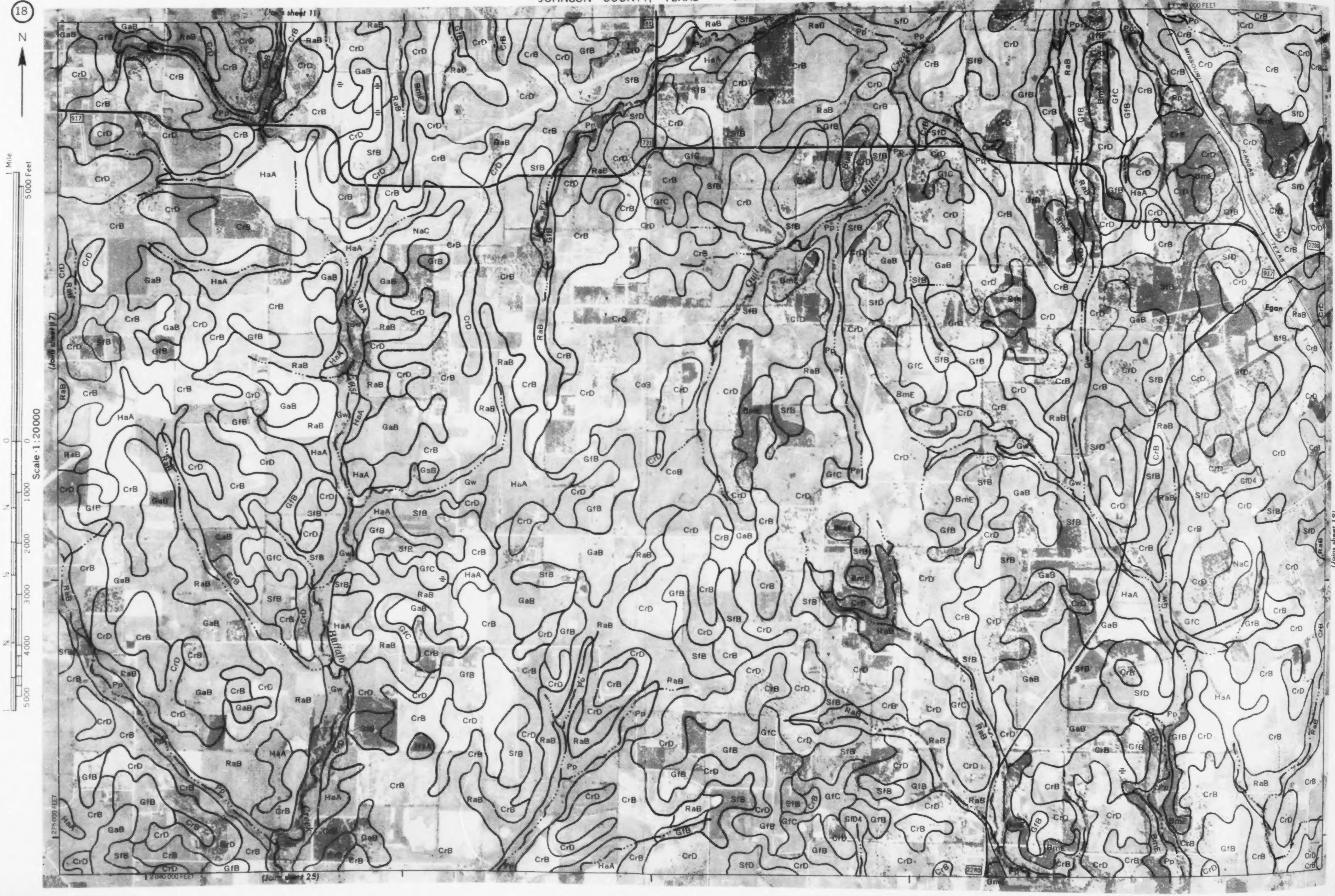
JOHNSON COUNTY, TEXAS — SHEET NUMBER 16


16
N
(Joins sheet 9)
(Joins sheet 15)
(Joins sheet 23)
2 010 000 FEET
1 990 000 FEET
275 000 FEET
Scale 1:20000
5 000 Feet
0
1 000
2 000
3 000
4 000
5 000
Godley
Nolan
West
Nolan
Creek
River
Wallace
Branch
TOPEKA
AND
SANTA
FE
2331
2135
917
171

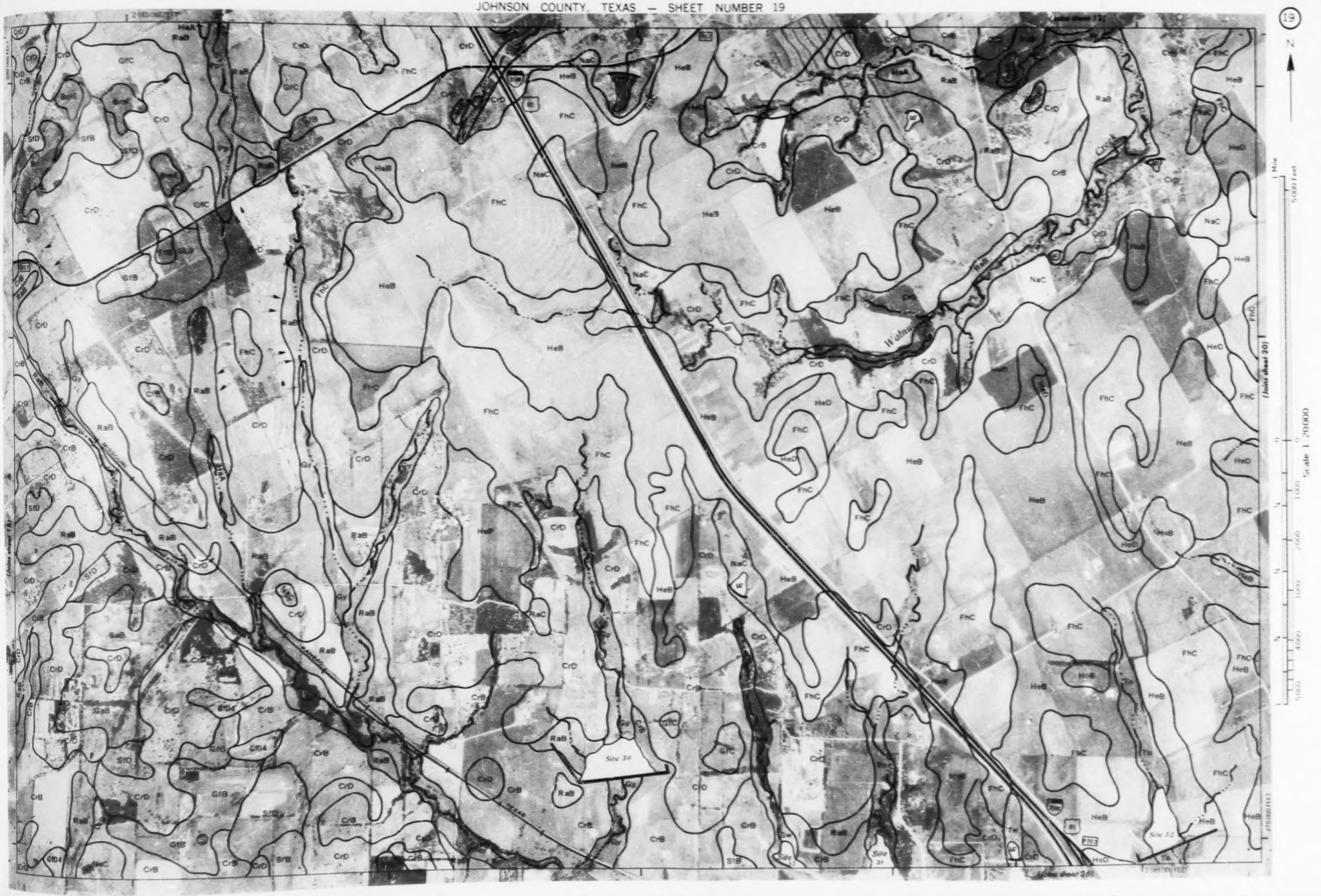
JOHNSON COUNTY, TEXAS — SHEET NUMBER 17


17
N
(Joins sheet 10)
(Joins sheet 24)
(Joins sheet 16)
(Joins sheet 18)
Joshua
Brushy Knob
Martin Branch
West Buffalo Creek
SANTA FE
ATCHISON TOPEKA AND
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
2 035 000 FEET
2 016 000 FEET
276 000 FEET
917
1902
174
SlB
LoB
SaB
SaC
PnB
PnC
CrB
CrD
CuB
BmE
GfB
GfC
GaB
RaB
SfB
SfD
HaA
WsA
WsB
BuA
Gw
Fr
Pr
MeE
SlA
LtB
AbC
HnB
CoB
w

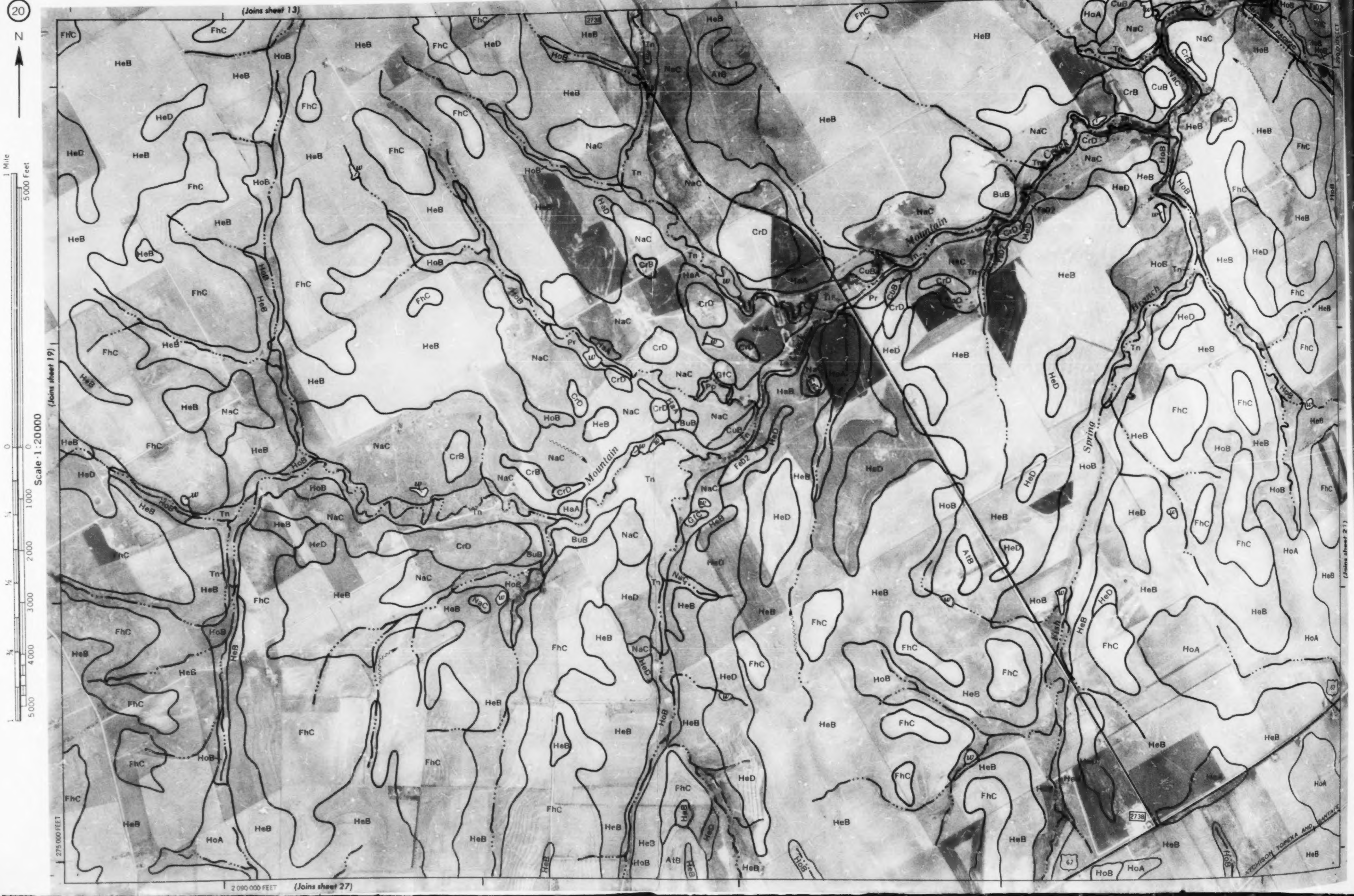
JOHNSON COUNTY, TEXAS — SHEET NUMBER 18


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 11)
(Joins sheet 17)
(Joins sheet 19)
(Joins sheet 25)
2 040 000 FEET
275 000 FEET
917
731
2280
Egan
Buffalo
Creek
Miller
Creek
Quil
Missouri
Kansas
Texas
CrB
CrD
GaB
GfB
GfC
HaA
NaC
RaB
SfB
SfD
Pp
Gw
BmE
CoB
GfD4

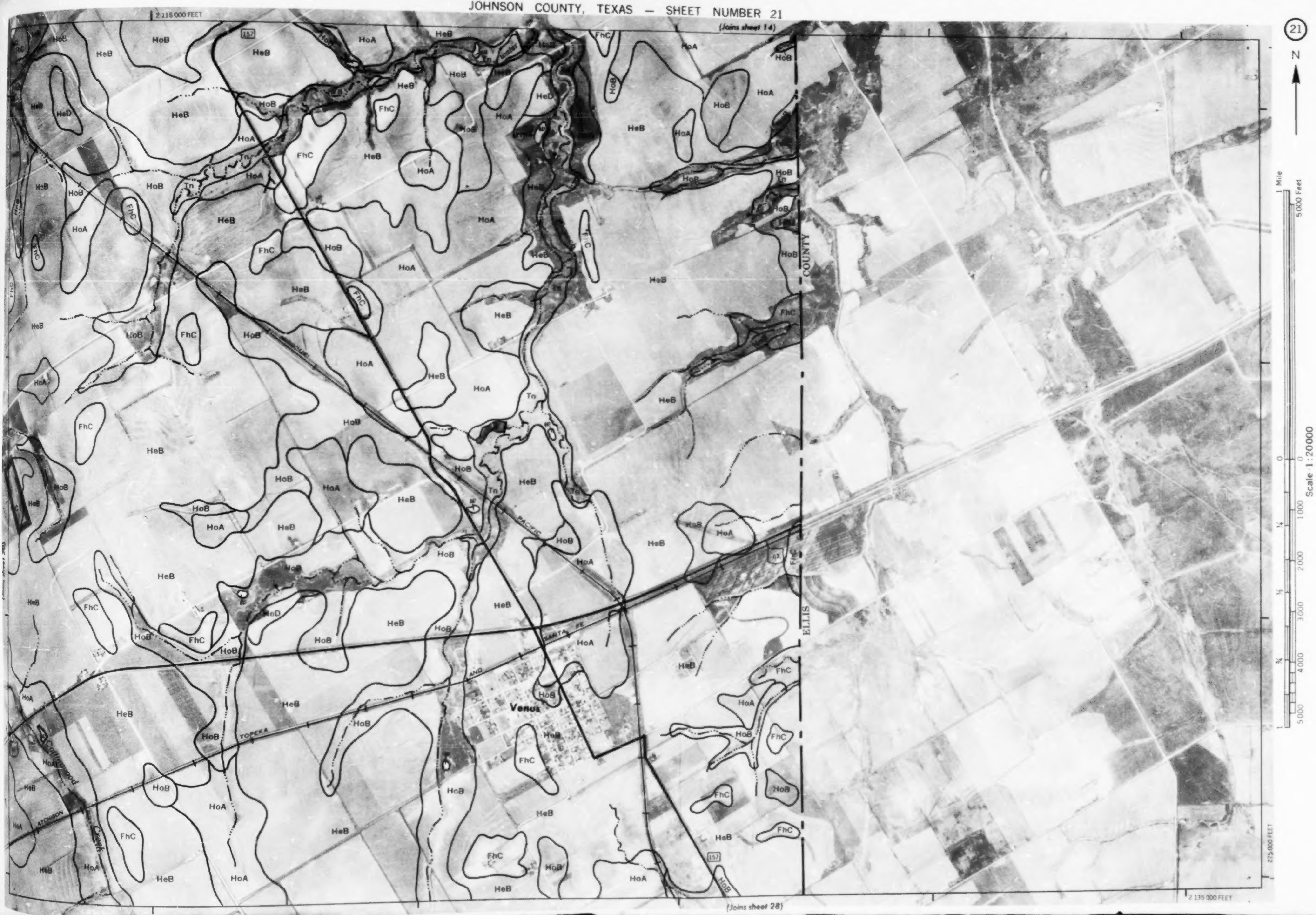
JOHNSON COUNTY, TEXAS — SHEET NUMBER 19


19
N
(Joins sheet 13)
(Joins sheet 20)
(Joins sheet 18)
(Joins sheet 26)
2 065 000 FEET
280 000 FEET
275 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
Walnut Creek
MISSOURI
KANSAS
TEXAS
Site 30
Site 31
Site 32
CrD
CrB
CrD2
HeB
HeD
FhC
NaC
RaB
GfC
GfB
GfD
SfB
SfD
Gy
Tn
HoB
SaB
GaB
BkE

JOHNSON COUNTY, TEXAS — SHEET NUMBER 20

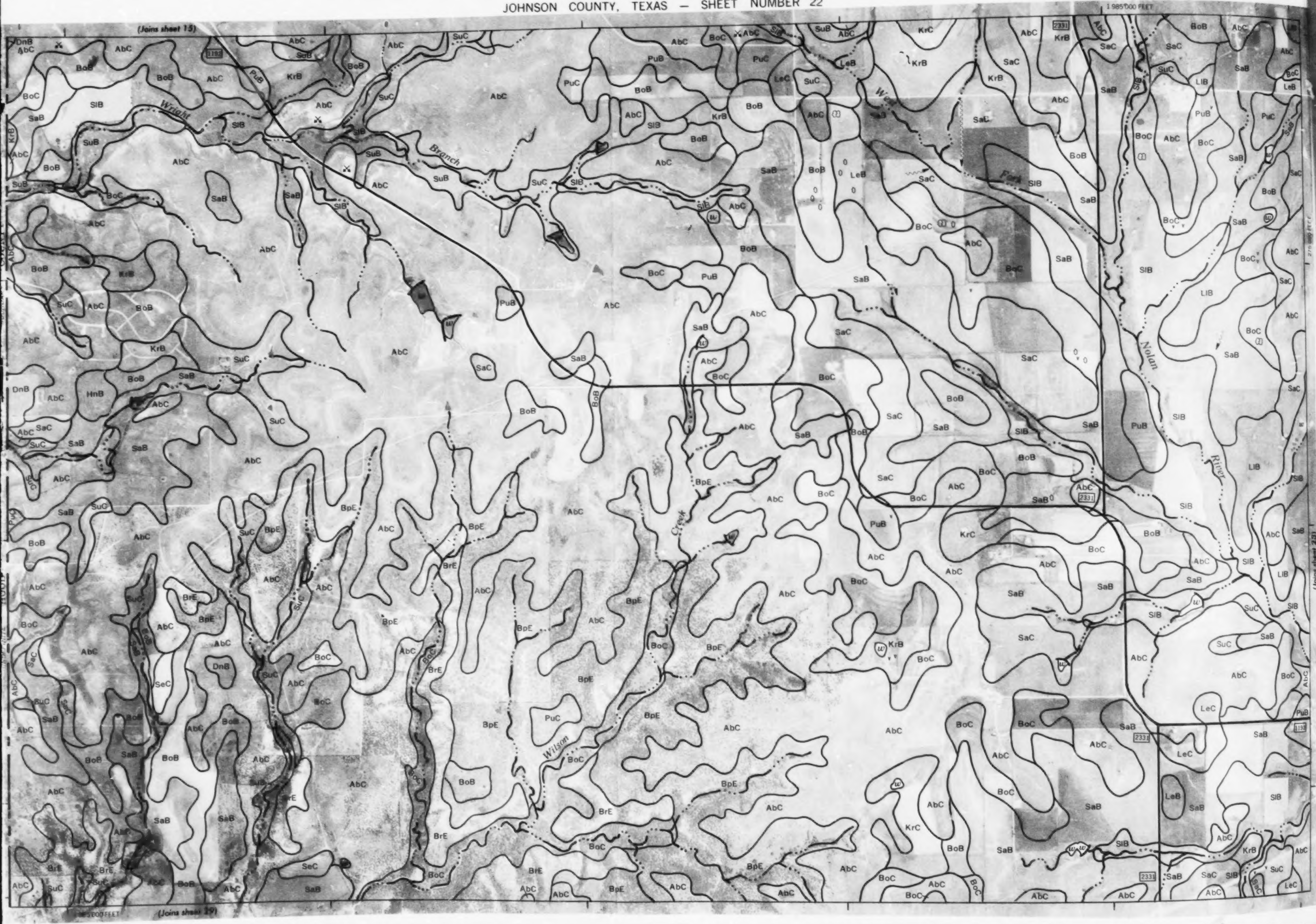

⑳
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
(Joins sheet 13)
(Joins sheet 19)
(Joins sheet 21)
(Joins sheet 27)
2 090 000 FEET
275 000 FEET
Mountain
Creek
Spring
Branch
Fish
2738
67
MISSOURI PACIFIC
ATCHISON TOPEKA AND SANTA FE
AtB
BuB
CrB
CrD
CuB
FeD2
FhC
GfC
HaA
HaD
HeB
HeD
HoA
HoB
NaC
Pr
Tn
w

JOHNSON COUNTY, TEXAS — SHEET NUMBER 21

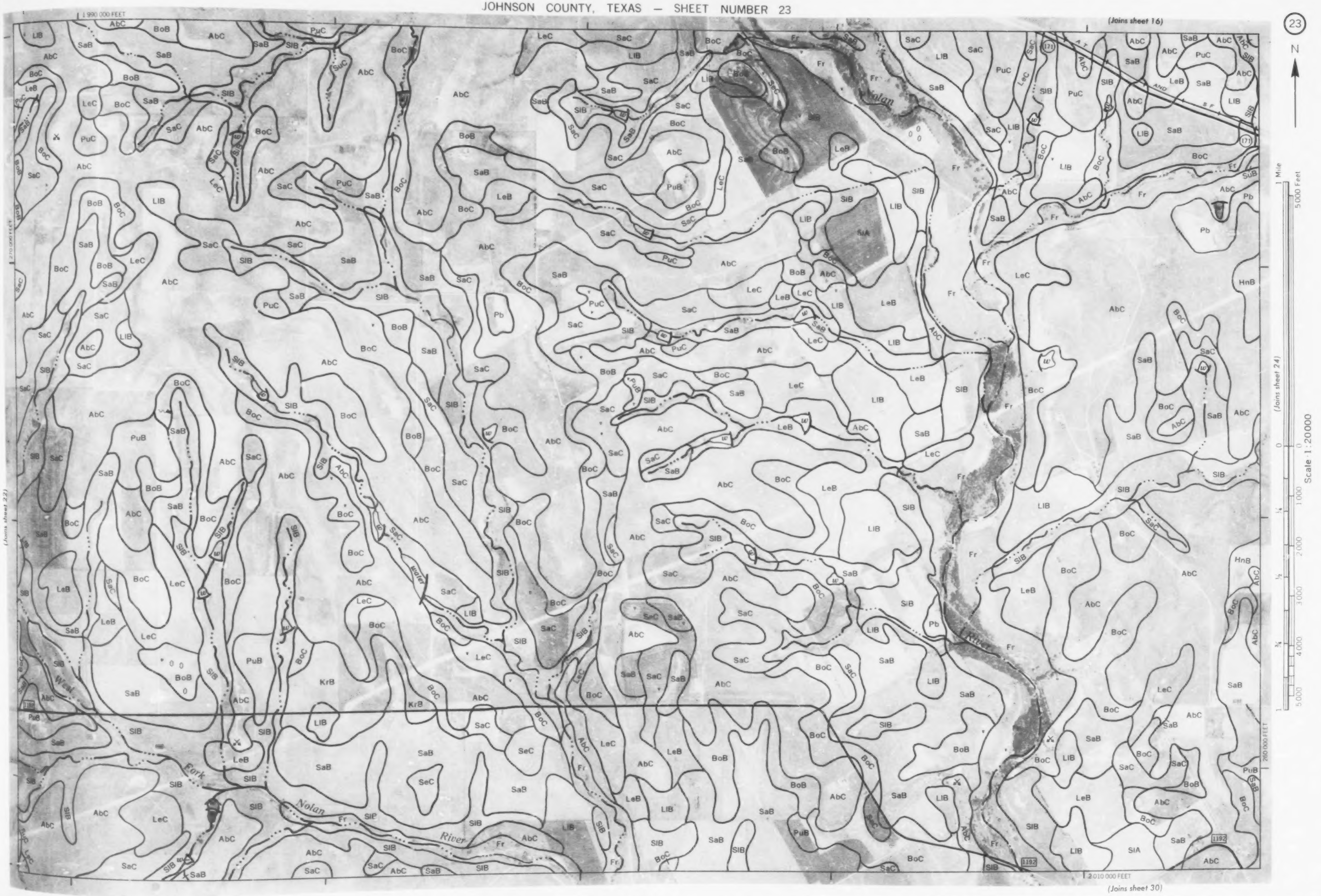


21
N
(Joins sheet 14)
(Joins sheet 28)
2 115 000 FEET
2 135 000 FEET
275 000 FEET
ELLIS COUNTY
Venus
157
67
Creek
Cottonwood
ATCHISON
TOPEKA
AND
SANTA FE
MISSOURI
PACIFIC
1 Mile
5000 Feet
1/4
1/2
3/4
0
1000
2000
3000
4000
5000
Scale 1:20000
HeB
HoB
HoA
HeD
FhC
Tn

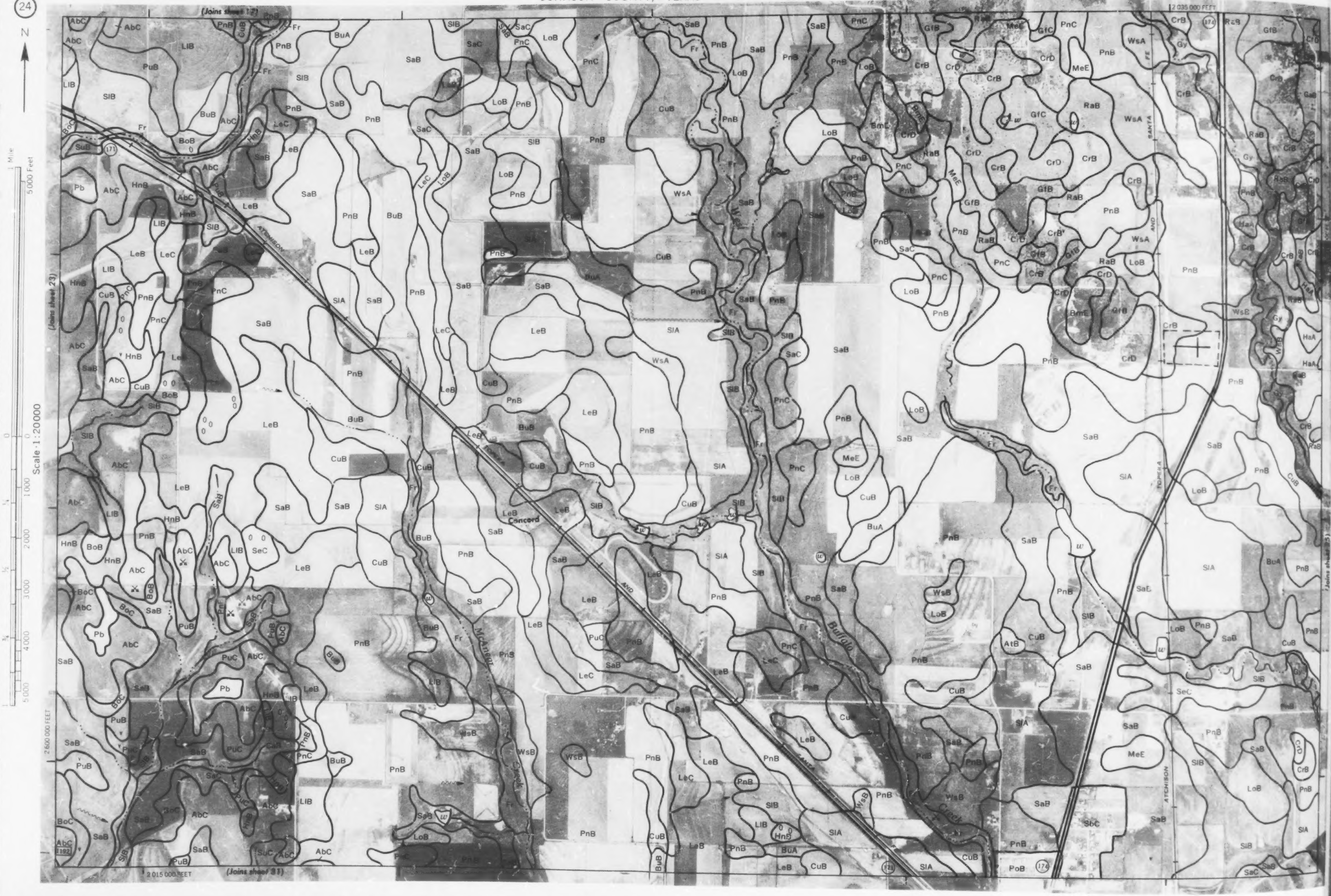
JOHNSON COUNTY, TEXAS — SHEET NUMBER 22


(Joins sheet 15)
(Joins sheet 29)
(Joins sheet 23)
1 985 000 FEET
270 000 FEET
Wright Branch
West Fork
Nolan River
Wilson Creek
1192
2331
AbC
BoB
BoC
BpE
BrE
DnB
HnB
KrB
KrC
LeB
LeC
LlB
PuB
PuC
SaB
SaC
SeC
SlB
SuB
SuC

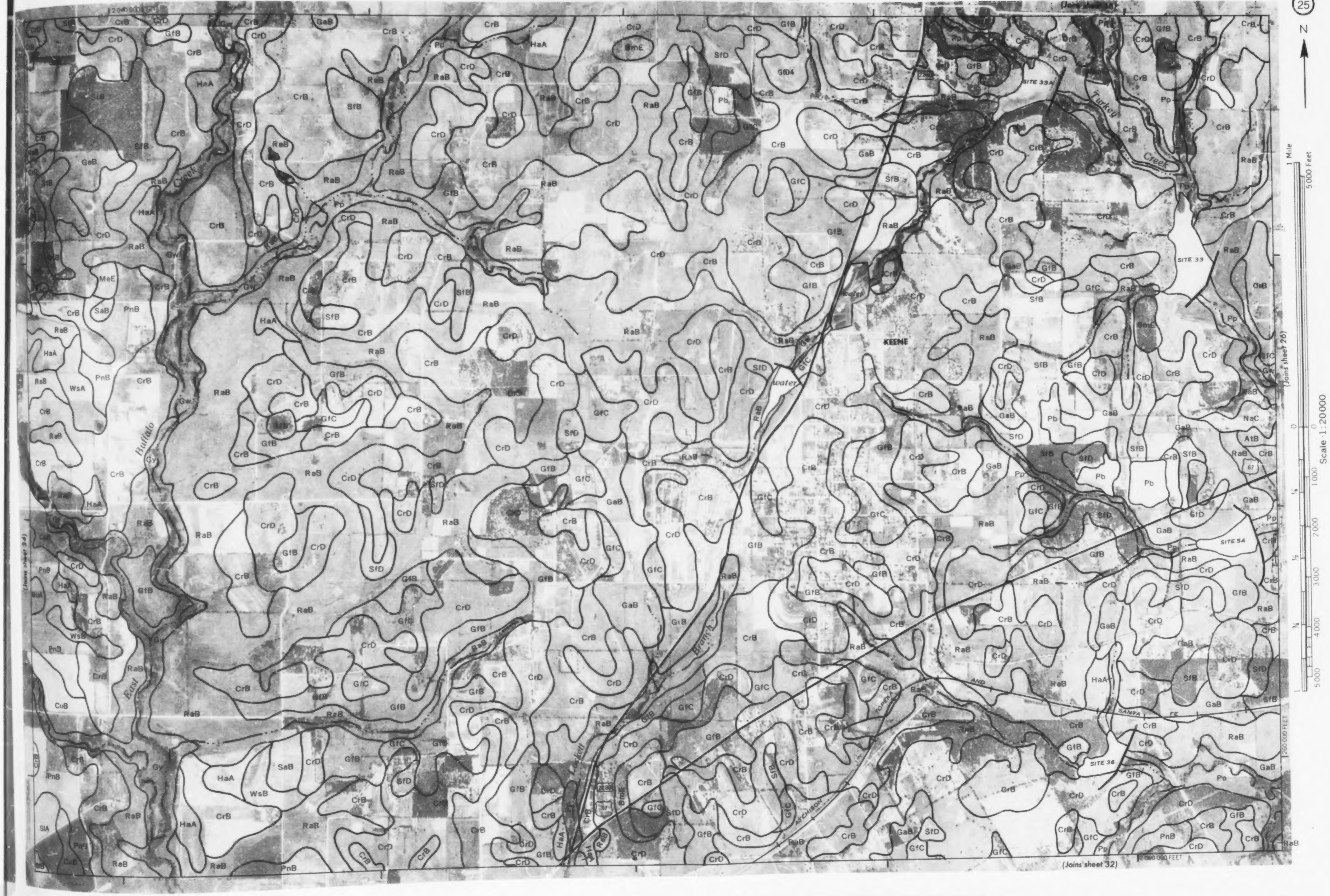
JOHNSON COUNTY, TEXAS — SHEET NUMBER 23


1 990 000 FEET
(Joins sheet 16)
N
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 30)
2 010 000 FEET
260 000 FEET
270 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Nolan
River
West
Fork
Nolan
River
water
A T AND S F
171
1192

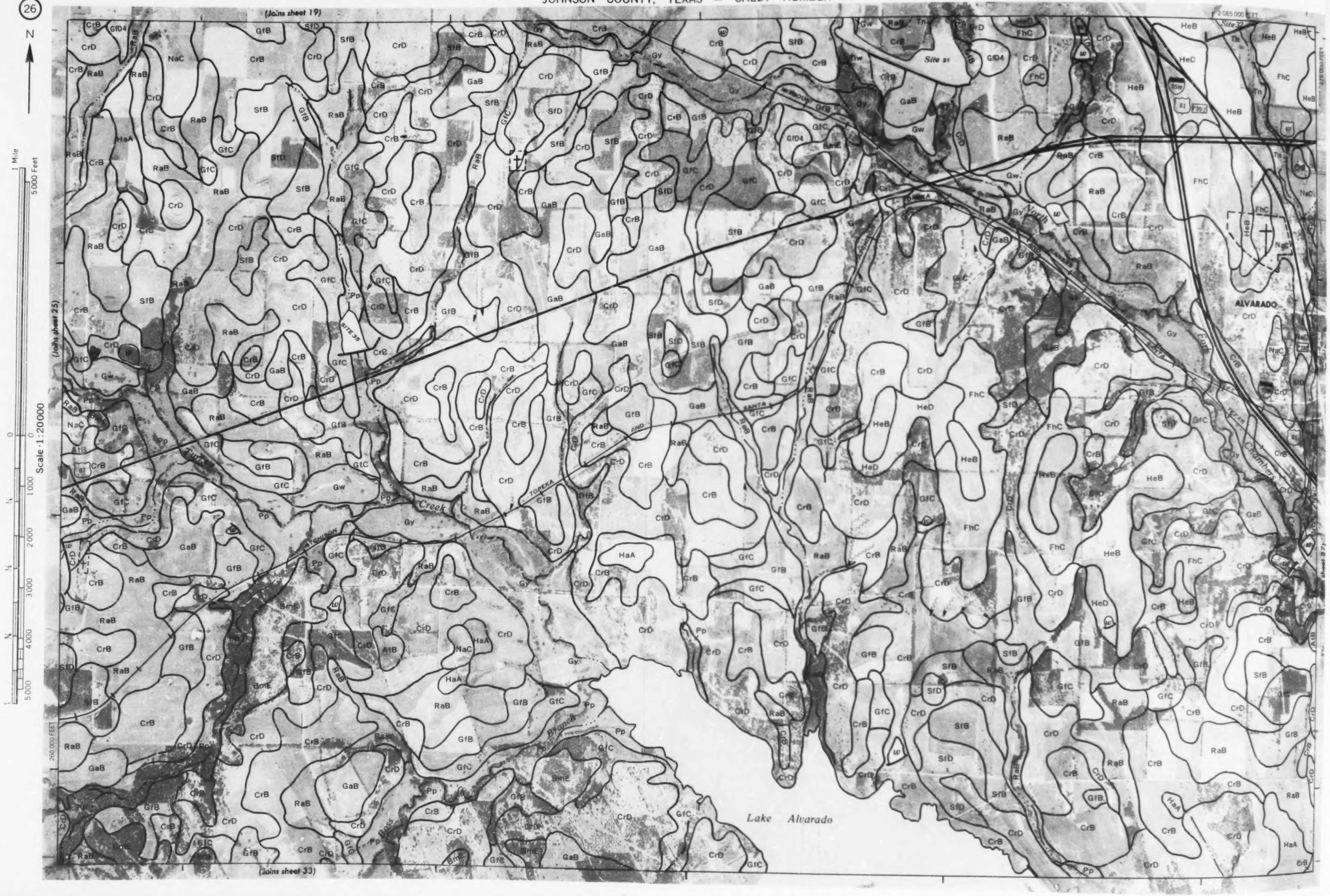
JOHNSON COUNTY, TEXAS — SHEET NUMBER 24

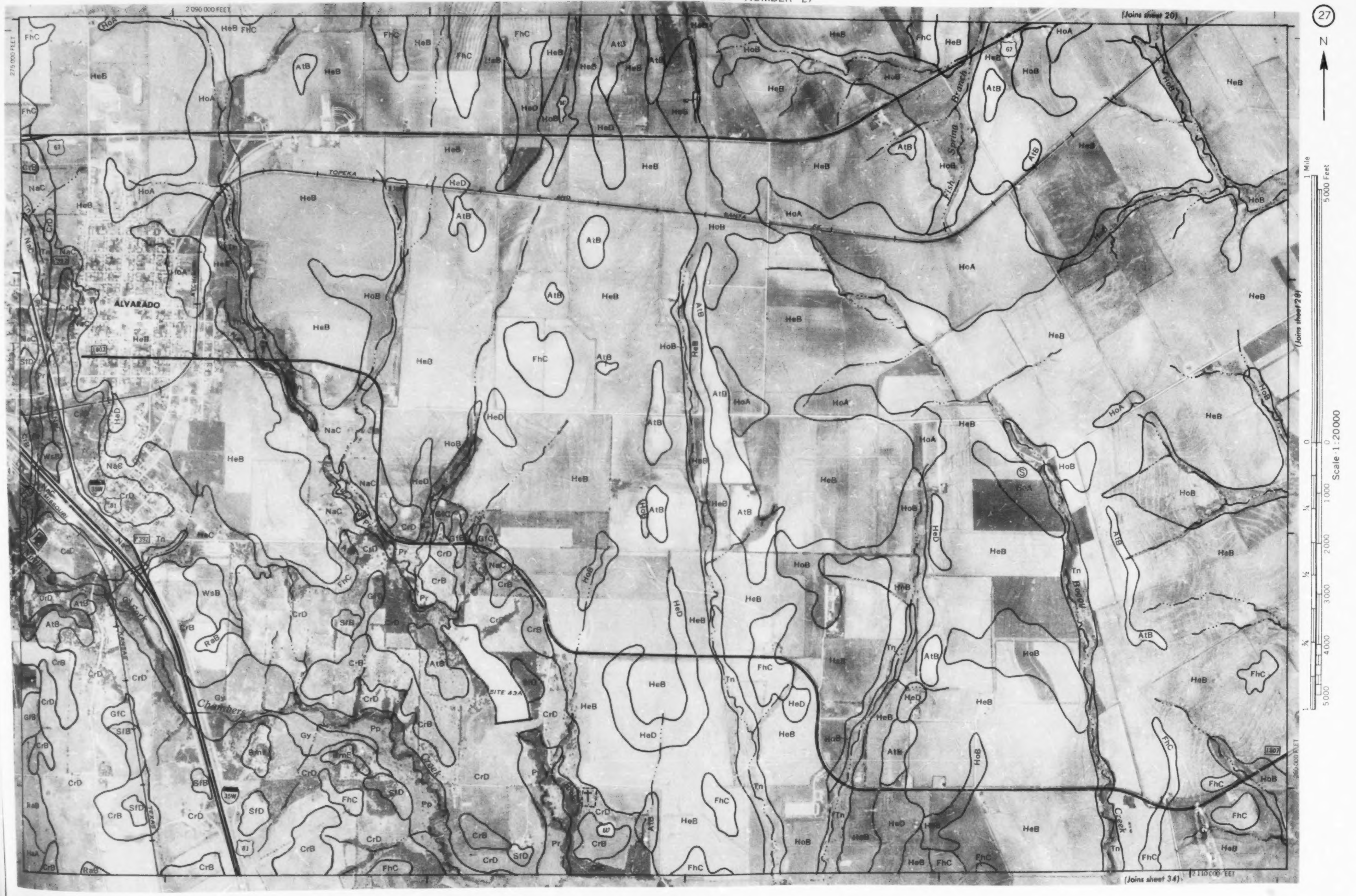

(24)
N
(Joins sheet 17)
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 31)
1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
2 035 000 FEET
2 600 000 FEET
2 015 000 FEET
ATCHISON
TOPEKA
AND
SANTA
FE
Concord
McAnear
Creek
Buffalo
Creek
171
174
1192
SaB
PnB
LeB
SIA
SIB
CuB
AbC
LoB
CrB
CrD
WsA
WsB
GfB
GfC
RaB
MeE
BuA
BuB
PnC
LeC
HnB
Fr
Pb
PuB
PuC
BoC
BoB
SaC
SeC
SbC
LIB
HaA
Gy
BmE
AtB
PoB
w

JOHNSON COUNTY, TEXAS — SHEET NUMBER 25

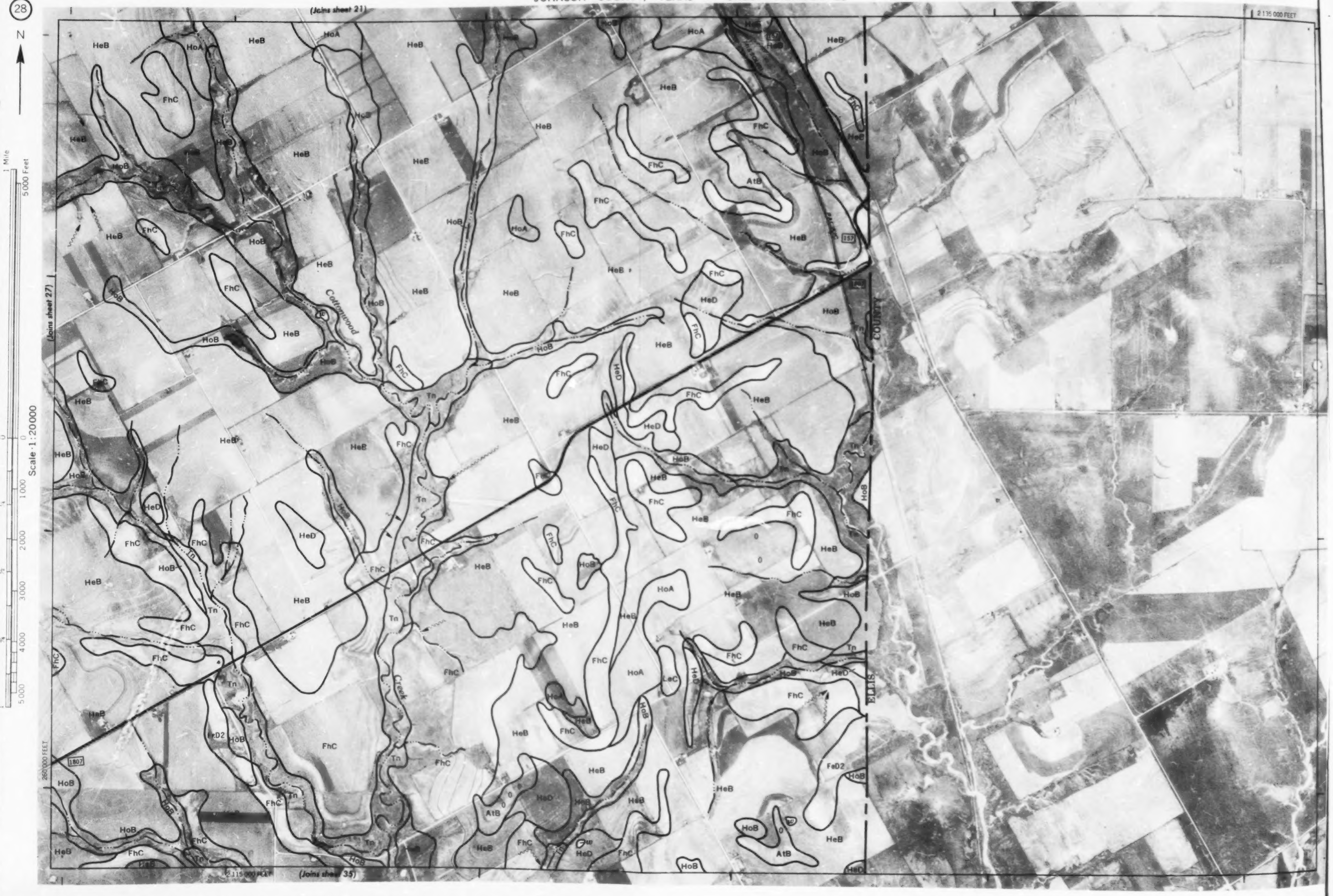

N
(Joins sheet 19)
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 24)
2 040 000 FEET
280 000 FEET
200 000 FEET
KEENE
East Buffalo Creek
Turkey Creek
Lockett Branch
water
SITE 33A
SITE 33
SITE 54
SITE 36
ATCHISON TOPEKA AND SANTA FE
67
1 Mile
5000 Feet
Scale 1:20000
0 1000 2000 3000 4000 5000
CrB
CrD
RaB
SfB
SfD
GfB
GfC
GaB
HaA
Pb
Pp
Gw
Gy
BmE
MeE
SaB
PnB
WsA
WsB
CuB
SlA
NaC
AtB

JOHNSON COUNTY, TEXAS — SHEET NUMBER 26

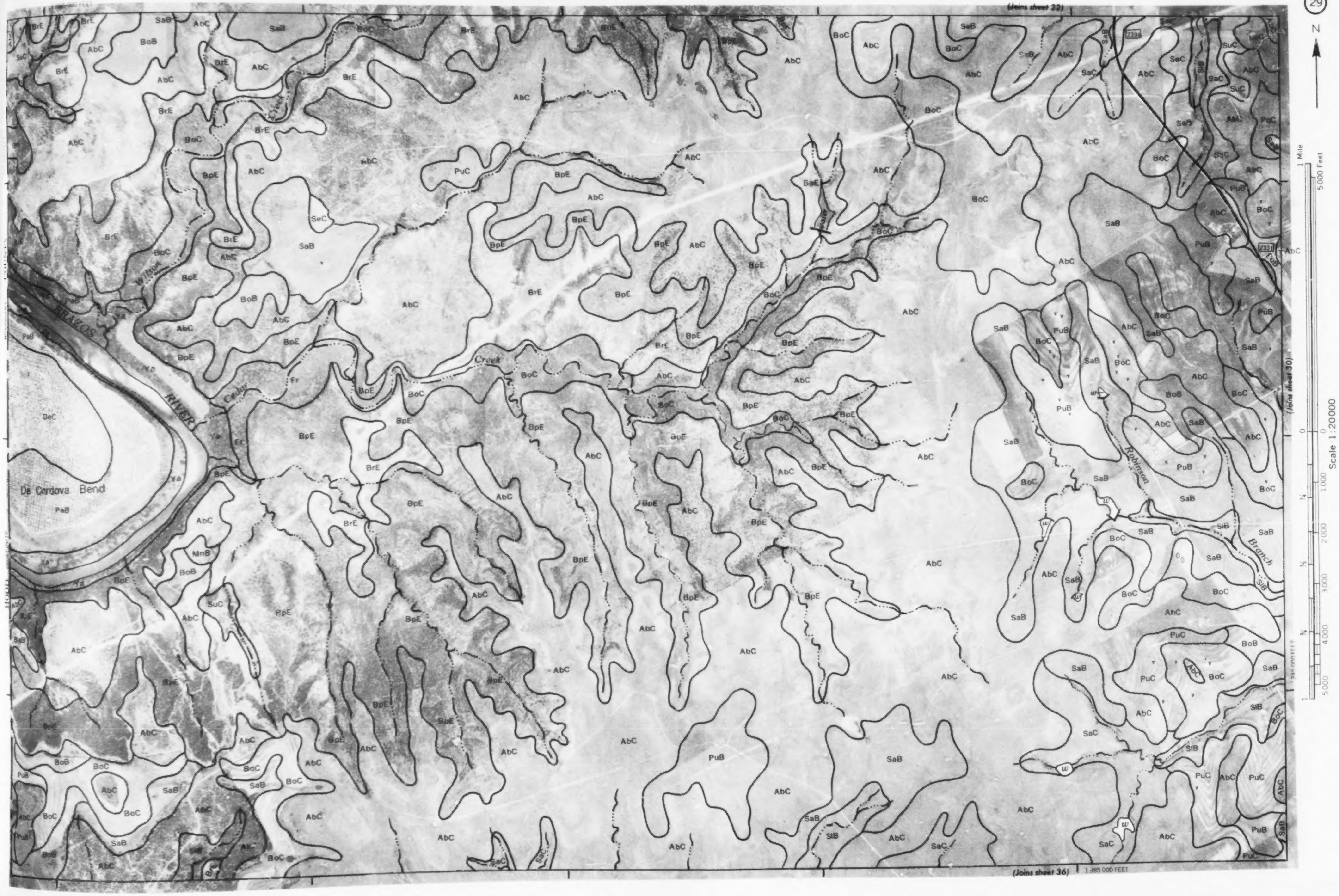

(Joins sheet 19)
(Joins sheet 25)
(Joins sheet 33)
(Joins sheet 27)
N
Scale 1:20000
1 Mile
5000 Feet
0 1000 2000 3000 4000 5000
0 ¼ ½ ¾ 1
2 085 000 FEET
260 000 FEET
ALVARADO
Lake Alvarado
Turkey Creek
Bass Branch
North Fork Chambers Creek
MISSOURI PACIFIC
ATCHISON TOPEKA AND SANTA FE
Site 35
Site 31
Site 32
35W
81
67
CrB
CrD
RaB
GfB
GfC
SfB
SfD
GaB
Gw
Gy
HeB
HeD
FhC
NaC
HaA
Pp
BmE
AtB
GfD4
Tn

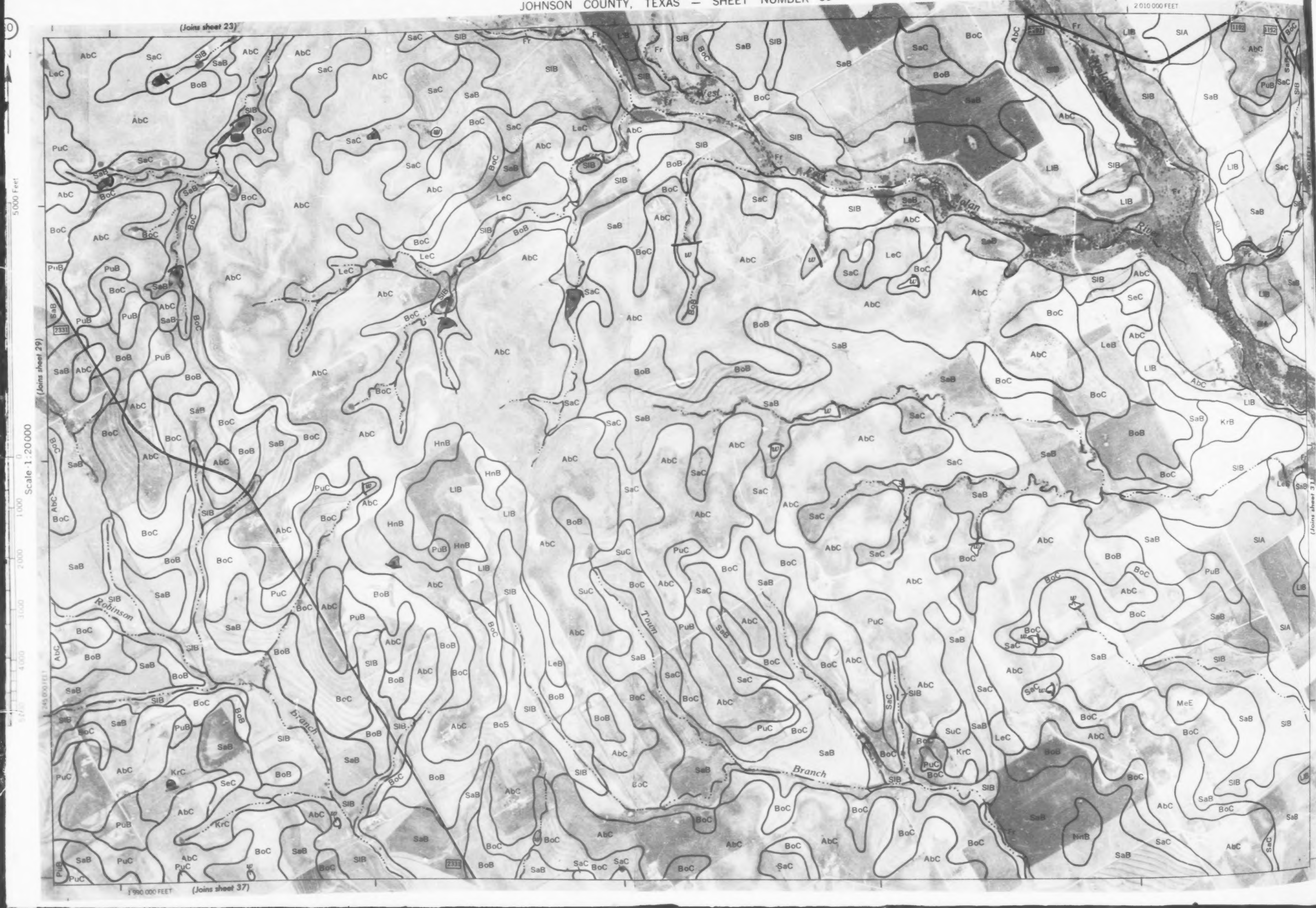

27
N
(Joins sheet 20)
(Joins sheet 28)
(Joins sheet 34)
2 090 000 FEET
275 000 FEET
2 110 000 FEET
260 000 FEET
ALVARADO
TOPEKA AND SANTA FE
MISSOURI KANSAS TEXAS
Fish Spring Branch
Chambers Creek
Bouqu Creek
SITE 43A
67
81
35W
1807
392
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20000
HeB
HoA
HoB
HeD
FhC
AtB
At3
NaC
CrD
CrB
CrD
GfC
GfB
SfB
SfD
WsB
RaB
Tn
Pr
Pp
Gy
Bms
w
S

JOHNSON COUNTY, TEXAS — SHEET NUMBER 28

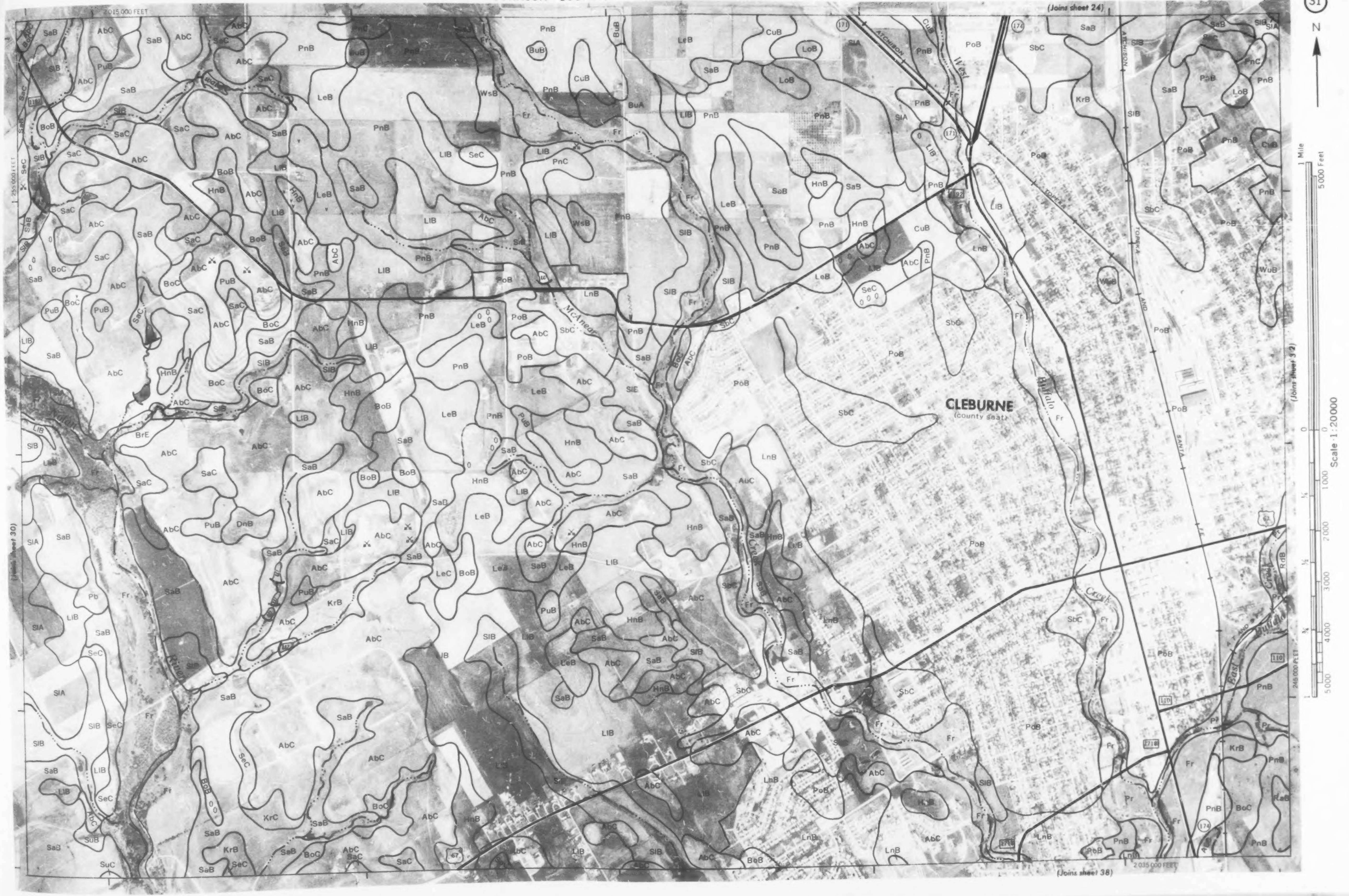

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 21)
(Joins sheet 27)
(Joins sheet 35)
2 135 000 FEET
2 115 000 FEET
260 000 FEET
Cottonwood
Creek
ELLIS
COUNTY
1807
157
HeB
HoA
HoB
FhC
AtB
HeD
Tn
FeD2
LeC

JOHNSON COUNTY, TEXAS — SHEET NUMBER 29

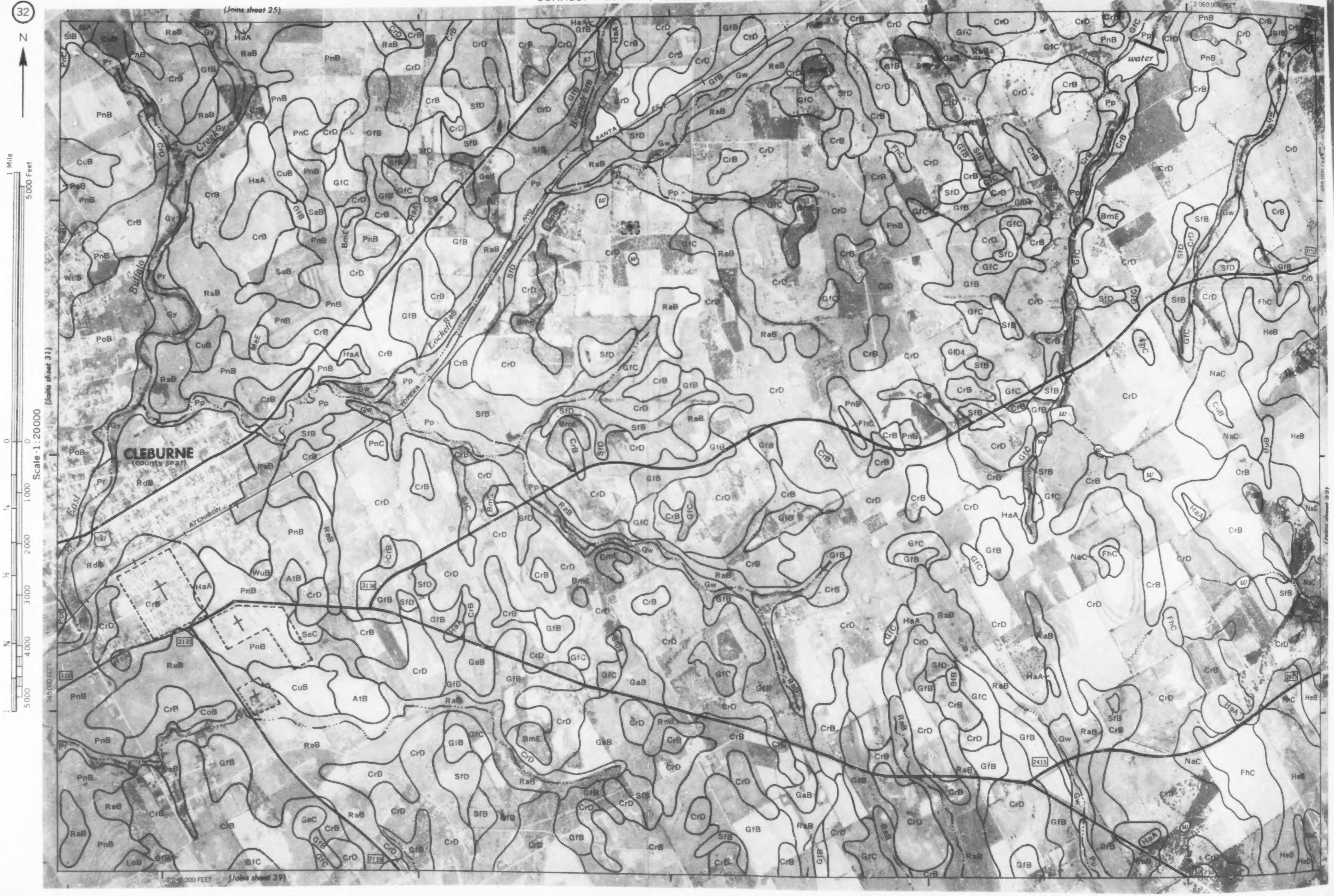

29
N
(Joins sheet 22)
(Joins sheet 30)
(Joins sheet 36)
1 385 000 FEET
245 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1000
2000
3000
4000
5000
BRAZOS
RIVER
De Cordova Bend
Wilson
Creek
Cedar
Creek
Robinson
Branch
2331
AbC
BoB
BoC
BpE
BrE
DeC
Fr
MnB
PaB
PuB
PuC
SaB
SaC
SeC
SlB
SuC
Ya
w


30
(Joins sheet 23)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 37)
2 010 000 FEET
1 990 000 FEET
5 000 Feet
Scale 1:20 000
West
Fork
Nolan
River
Robinson
Branch
Town
Branch
2331
1192
AbC
BoB
BoC
PuB
PuC
SaB
SaC
SlB
SlA
LeC
LlB
HnB
Fr
SuC
KrC
MeE

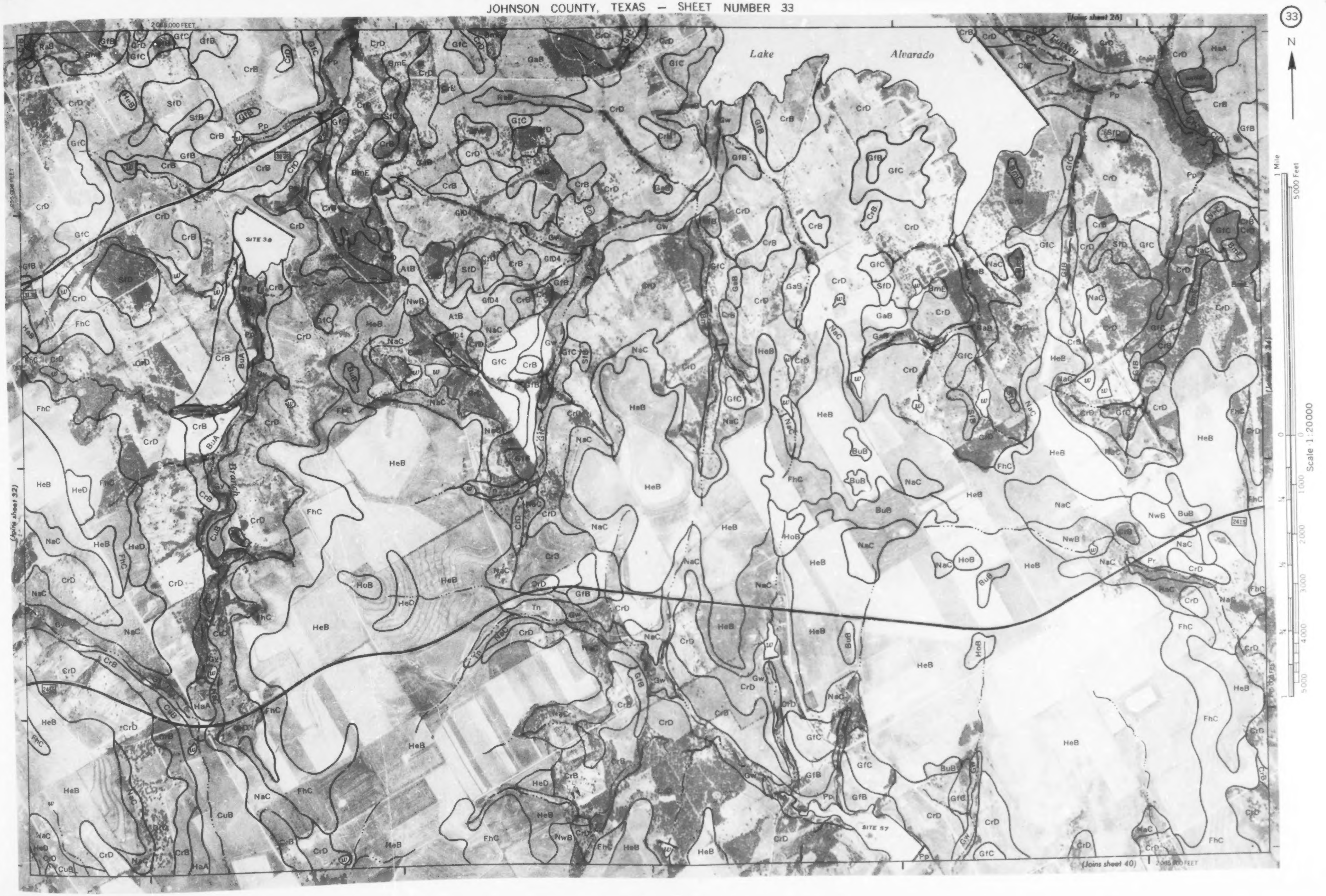
JOHNSON COUNTY, TEXAS — SHEET NUMBER 31


31
N
(Joins sheet 24)
(Joins sheet 30)
(Joins sheet 32)
(Joins sheet 38)
2 015 000 FEET
2 035 000 FEET
255 000 FEET
245 000 FEET
CLEBURNE
(county seat)
McAnear
Buffalo
Creek
East
West
River
ATCHISON
TOPEKA
AND
SANTA
FE
171
174
1192
1718
110
67
1 Mile
5000 Feet
0 1000 2000 3000 4000 5000
Scale 1:20000
AbC
SaB
SaC
PnB
LeB
LlB
SlB
SlA
SbC
PoB
BoB
BoC
BuB
CuB
LoB
HnB
Fr
WsB
PuB
SeC
LnB
KrB
Pr
AuC
BrE
DnB
LeC
XrC
SuC
SuB
RdB
WuB
PnC
BuA
Pb

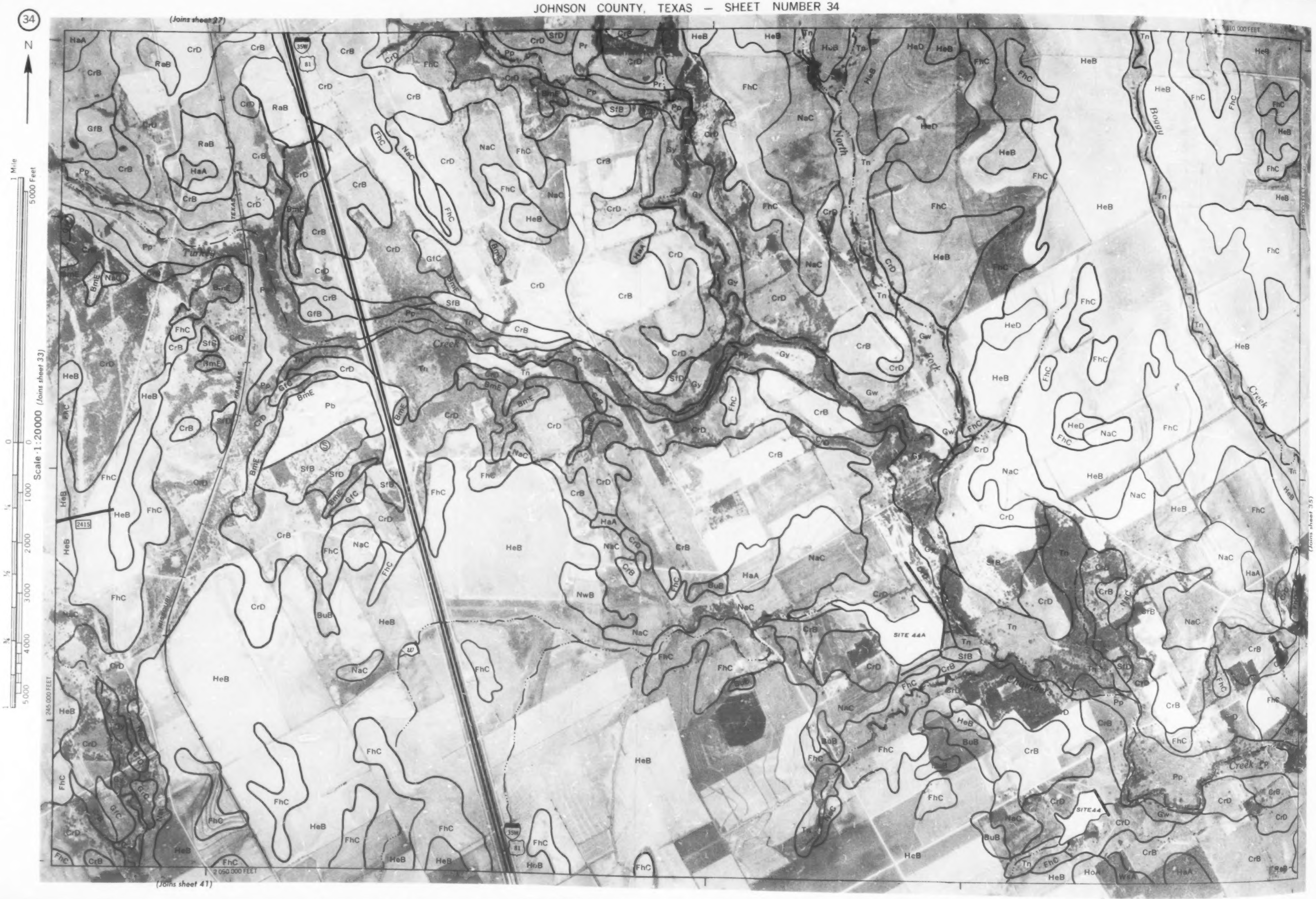
JOHNSON COUNTY, TEXAS — SHEET NUMBER 32


32
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
(Joins sheet 25)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 39)
2 060 000 FEET
2 040 000 FEET
245 000 FEET
265 000 FEET
CLEBURNE
(county seat)
East Buffalo Creek
Lockett Branch
SANTA FE
ATCHISON TOPEKA AND
water
67
3136
2135
110
2415
AtB
BmE
BuB
CfB
CoB
CrB
CrD
CuB
FhC
GaB
GaC
GfB
GfC
Gw
Gy
HaA
HeB
LoB
NaC
PnB
PnC
PoB
Pp
Pr
RaB
RdB
SaB
SeC
SfB
SfD
WuB
w

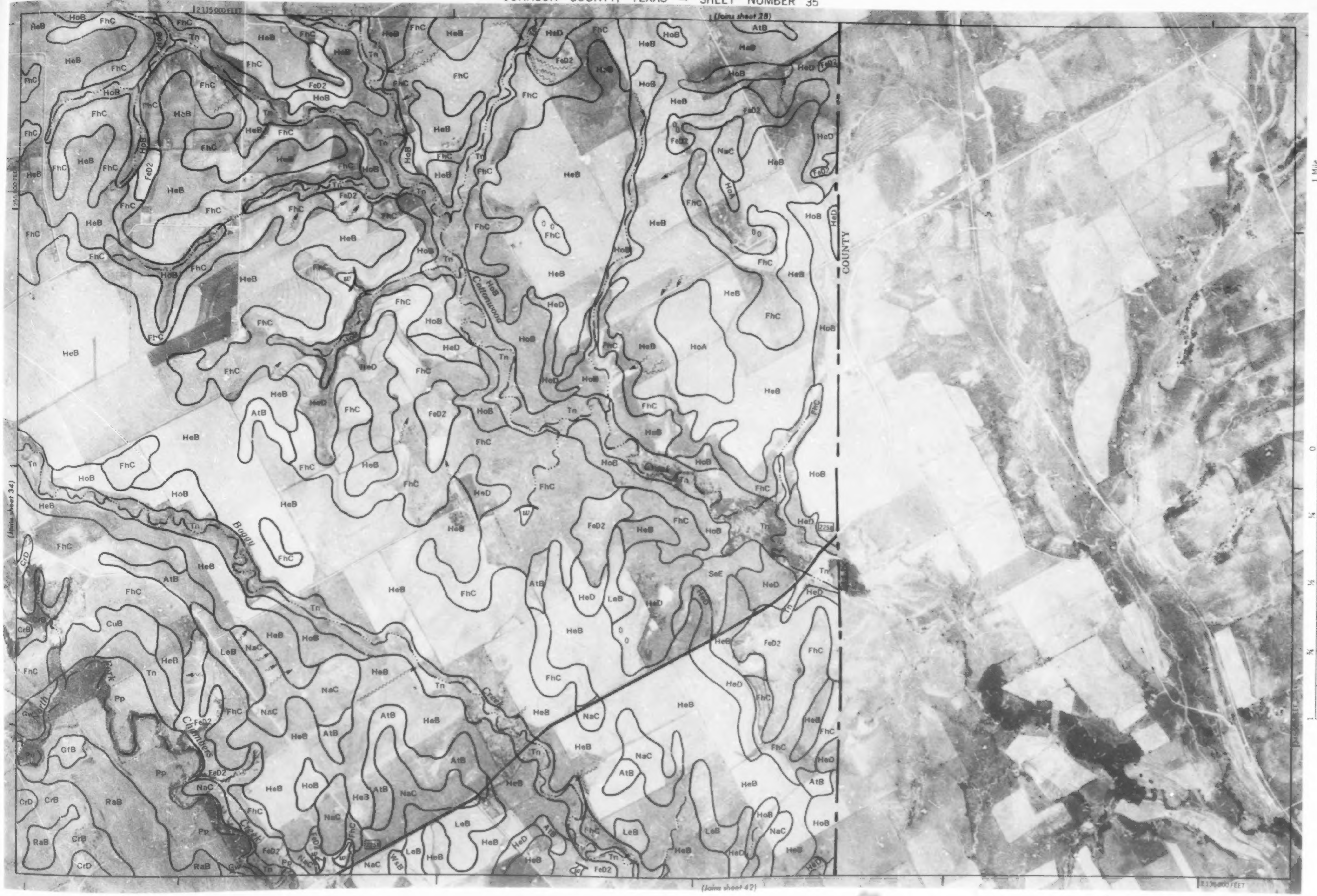
JOHNSON COUNTY, TEXAS — SHEET NUMBER 33


33
N
(Joins sheet 26)
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 40)
2 065 000 FEET
Lake Alvarado
SITE 38
SITE 57
Branch
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000

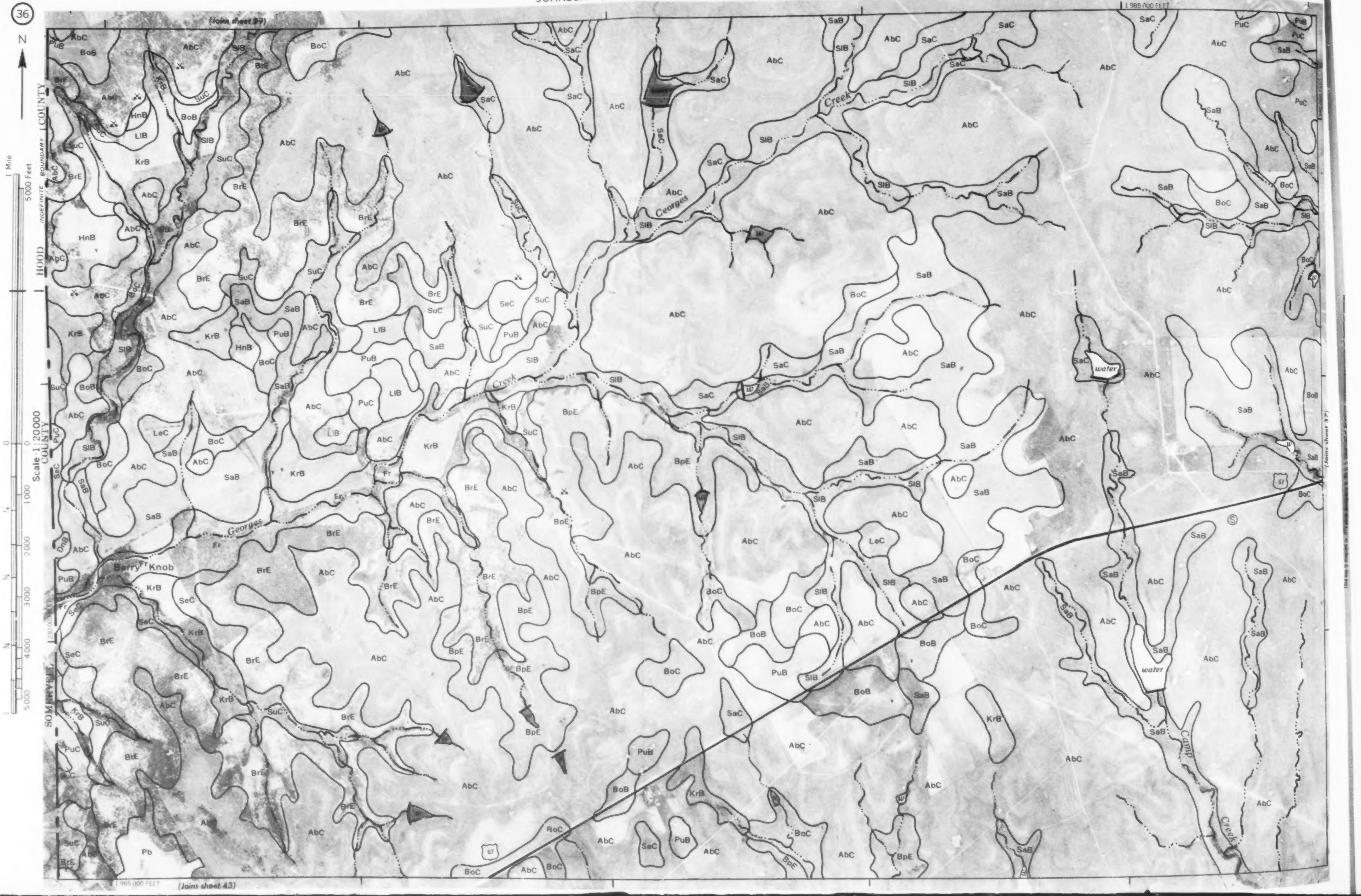
JOHNSON COUNTY, TEXAS — SHEET NUMBER 34


34
N
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
245 000 FEET
2 050 000 FEET
10 000 FEET
35W
81
2415
Turkey
Creek
North
Rock
Creek
Creek
Chambers
SITE 44A
SITE 44
HaA
CrD
CrB
RaB
GfB
RaB
HaA
Pp
CrD
BmE
NaC
SfB
SfD
HeB
FhC
Pb
GfC
BuB
NwB
NaC
Tn
Gy
Gw
Pr
HeD
W
WaA
HoA

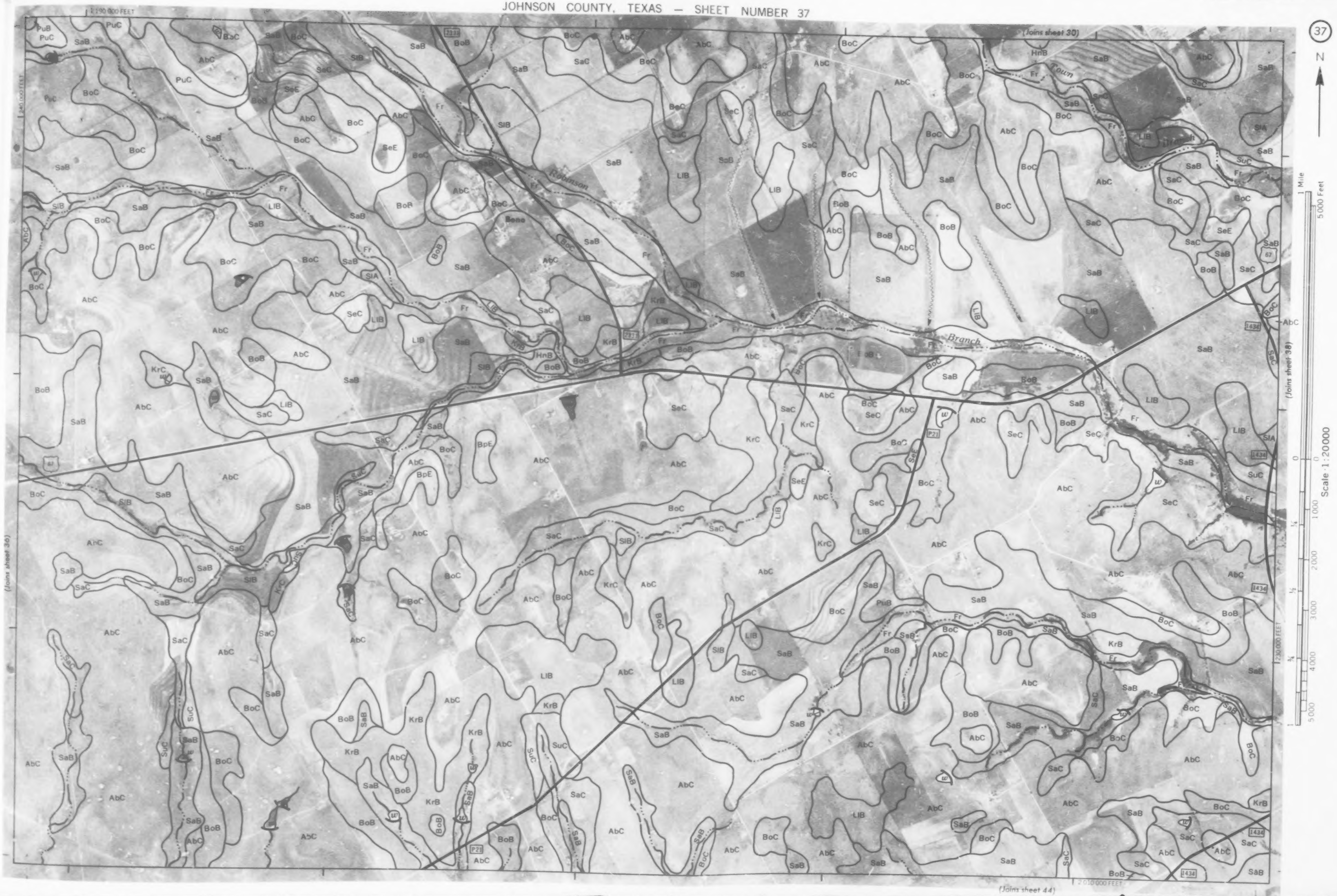
JOHNSON COUNTY, TEXAS — SHEET NUMBER 35

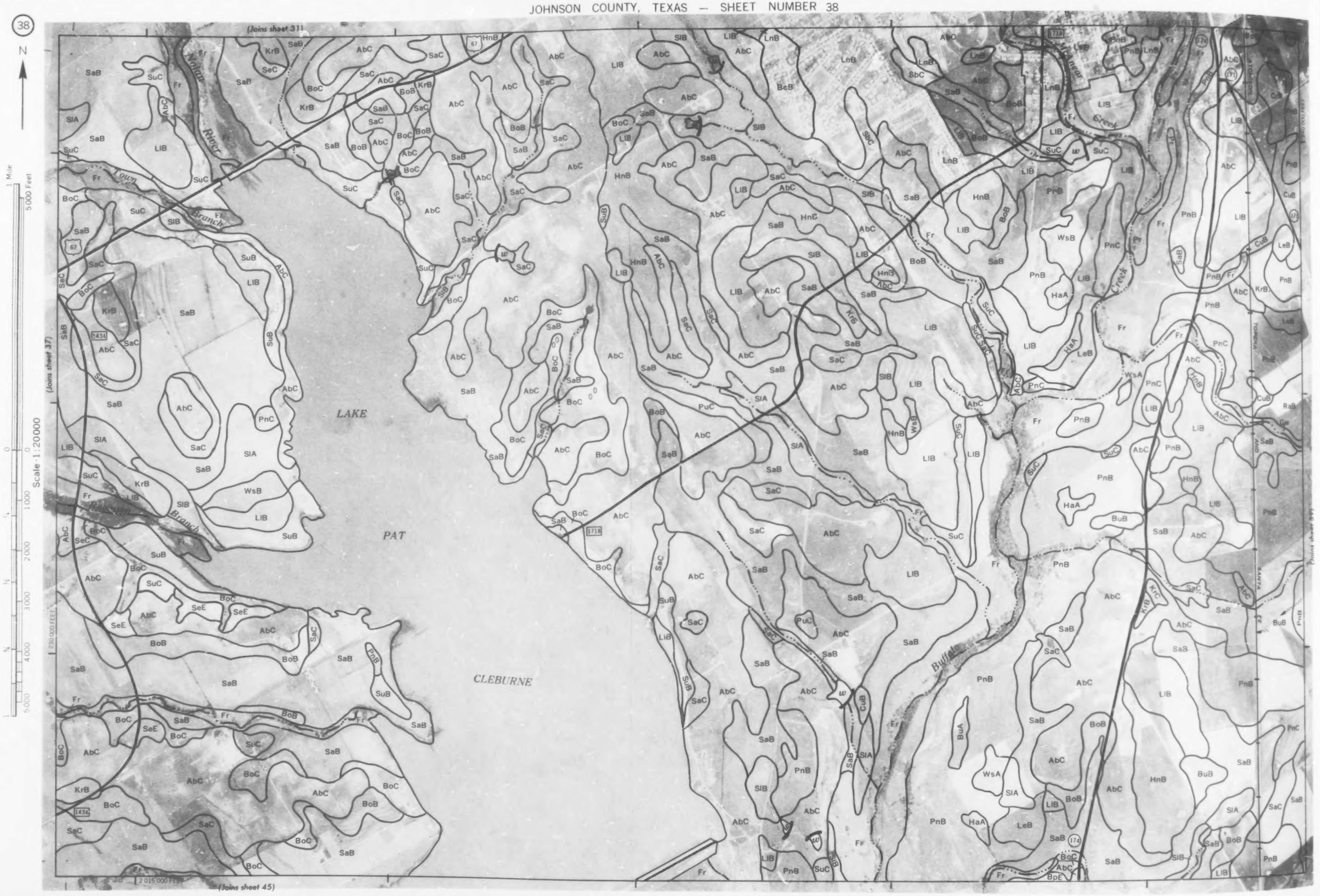

35
N
2 115 000 FEET
(Joins sheet 28)
(Joins sheet 34)
(Joins sheet 42)
255 000 FEET
2 135 000 FEET
COUNTY
Cottonwood
Boggy
Creek
Chambers
Creek
North
Rock
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
HeB
HoB
FhC
FeD2
Tn
HeD
HoA
NaC
AtB
LeB
SeE
CuB
CrB
CrD
RaB
GfB
Pp
Gw
WsB
HeO
w
2258

JOHNSON COUNTY, TEXAS — SHEET NUMBER 36

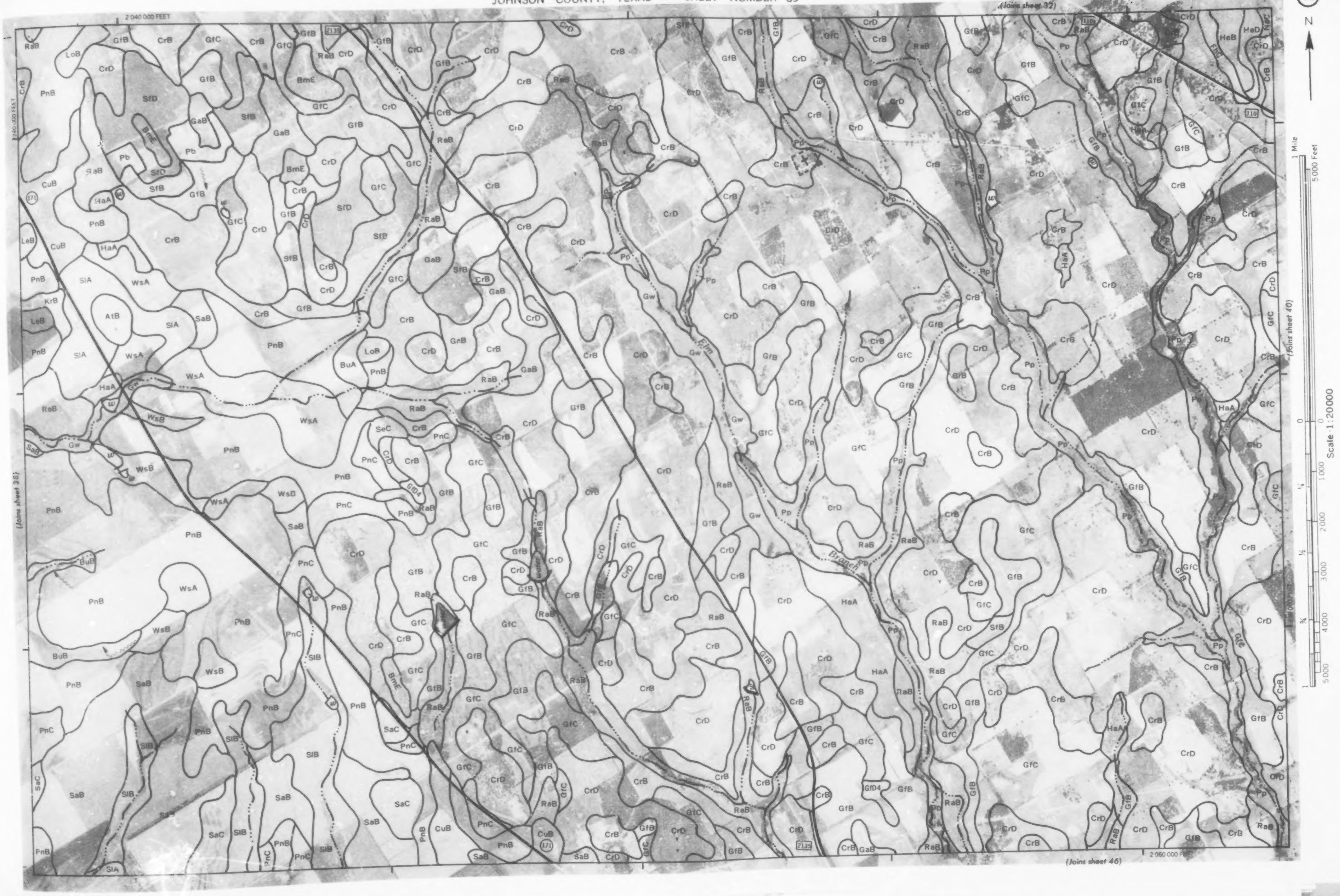

36
N
(Joins sheet 29)
(Joins sheet 37)
(Joins sheet 43)
1 985 000 FEET
1 965 000 FEET
HOOD COUNTY
INDEFINITE BOUNDARY
SOMERVELL COUNTY
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
Georges Creek
Camp Creek
Berry Knob
water
67
AbC
BoB
BoC
BpE
BrE
DnB
Fr
HnB
KrB
LeC
LlB
Pb
PuB
PuC
SaB
SaC
SeC
SlB
SuC
W

JOHNSON COUNTY, TEXAS — SHEET NUMBER 37

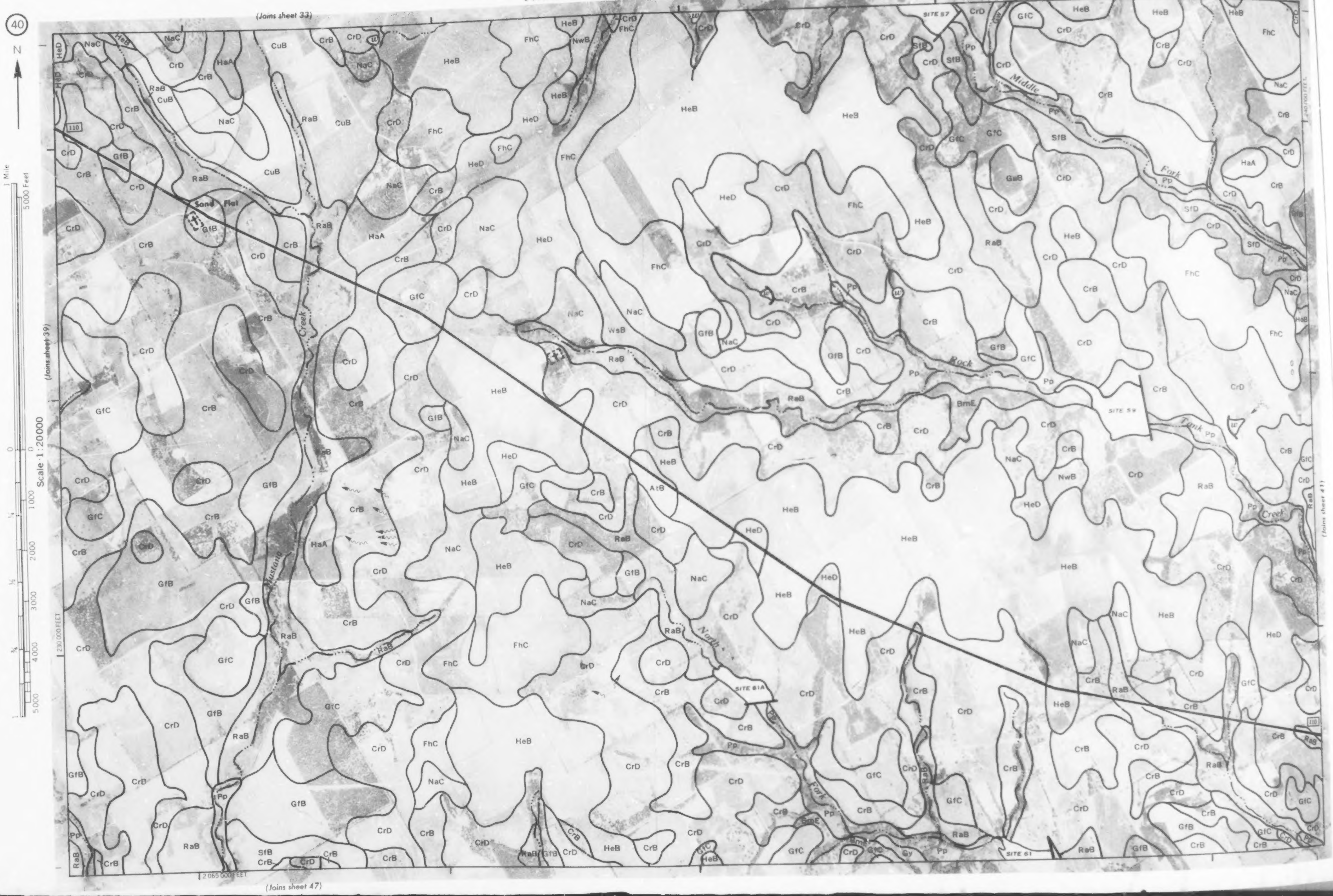

37
N
(Joins sheet 30)
(Joins sheet 38)
(Joins sheet 36)
(Joins sheet 44)
1 190 000 FEET
240 000 FEET
230 000 FEET
2 010 000 FEET
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1000
2000
3000
4000
5000
Robinson
Branch
Town
Branch
Bono
67
1434
P21
PuB
PuC
SaB
SaC
AbC
BoC
BoB
BpE
SlB
SlA
SeE
SeC
Fr
LlB
HnB
KrB
KrC
SuC
w


38
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 31)
(Joins sheet 37)
(Joins sheet 45)
(Joins sheet 39)
2 015 000 FEET
230 000 FEET
LAKE
PAT
CLEBURNE
Nolan River
Town Branch
Buffalo Creek
McAnear Creek
67
1434
1718
174
171

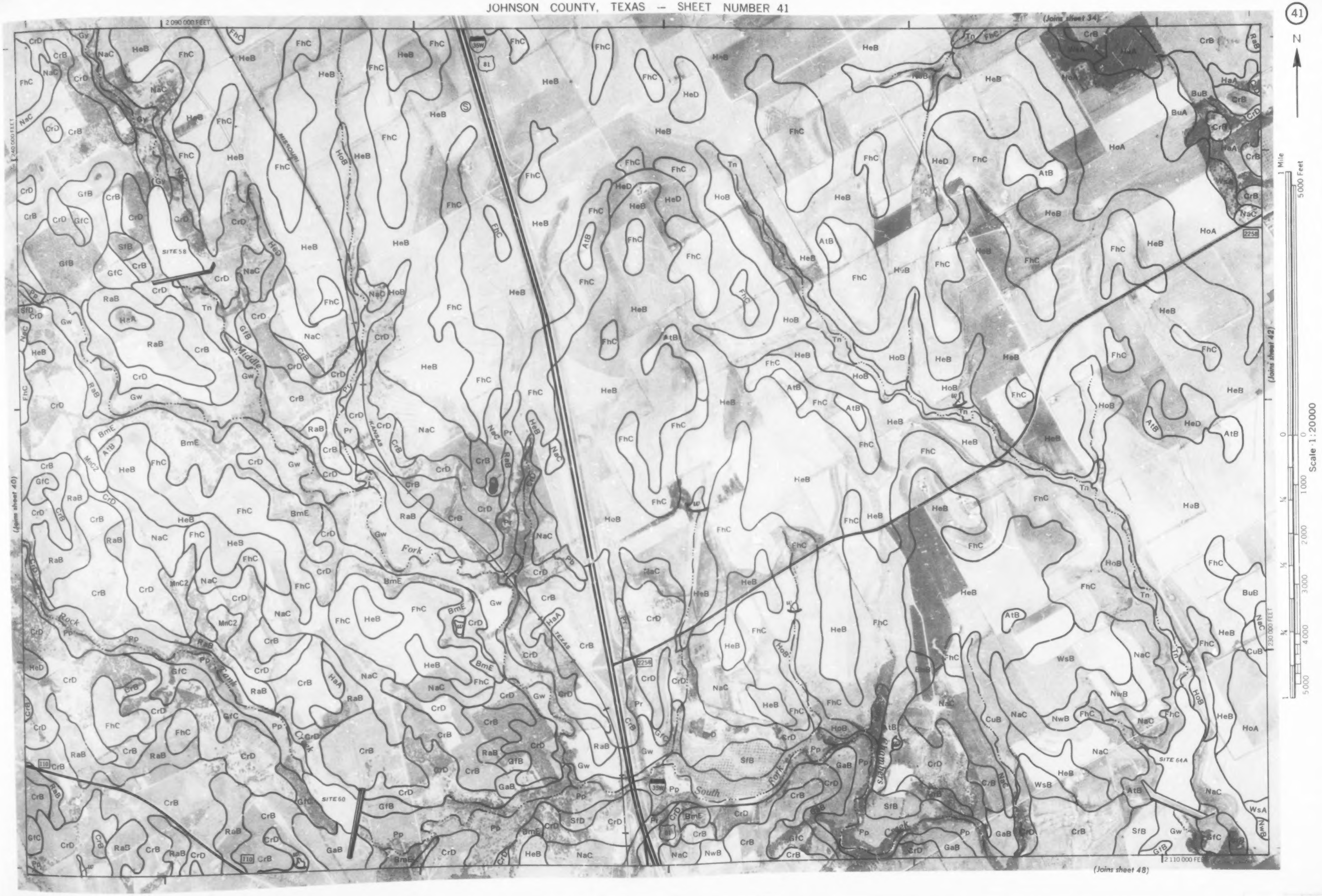
JOHNSON COUNTY, TEXAS — SHEET NUMBER 39


2 040 000 FEET
240 000 FEET
(Joins sheet 32)
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 46)
2 060 000 FEET
N
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
Scale 1:20000
Elm Branch
171
2135
1106
110
81
917
Water
CrD
CrB
GfB
GfC
RaB
PnB
PnC
WsA
WsB
SlA
SlB
SaB
SaC
SfB
SfD
BmE
GaB
CuB
HaA
LoB
LeB
Pp
Gw

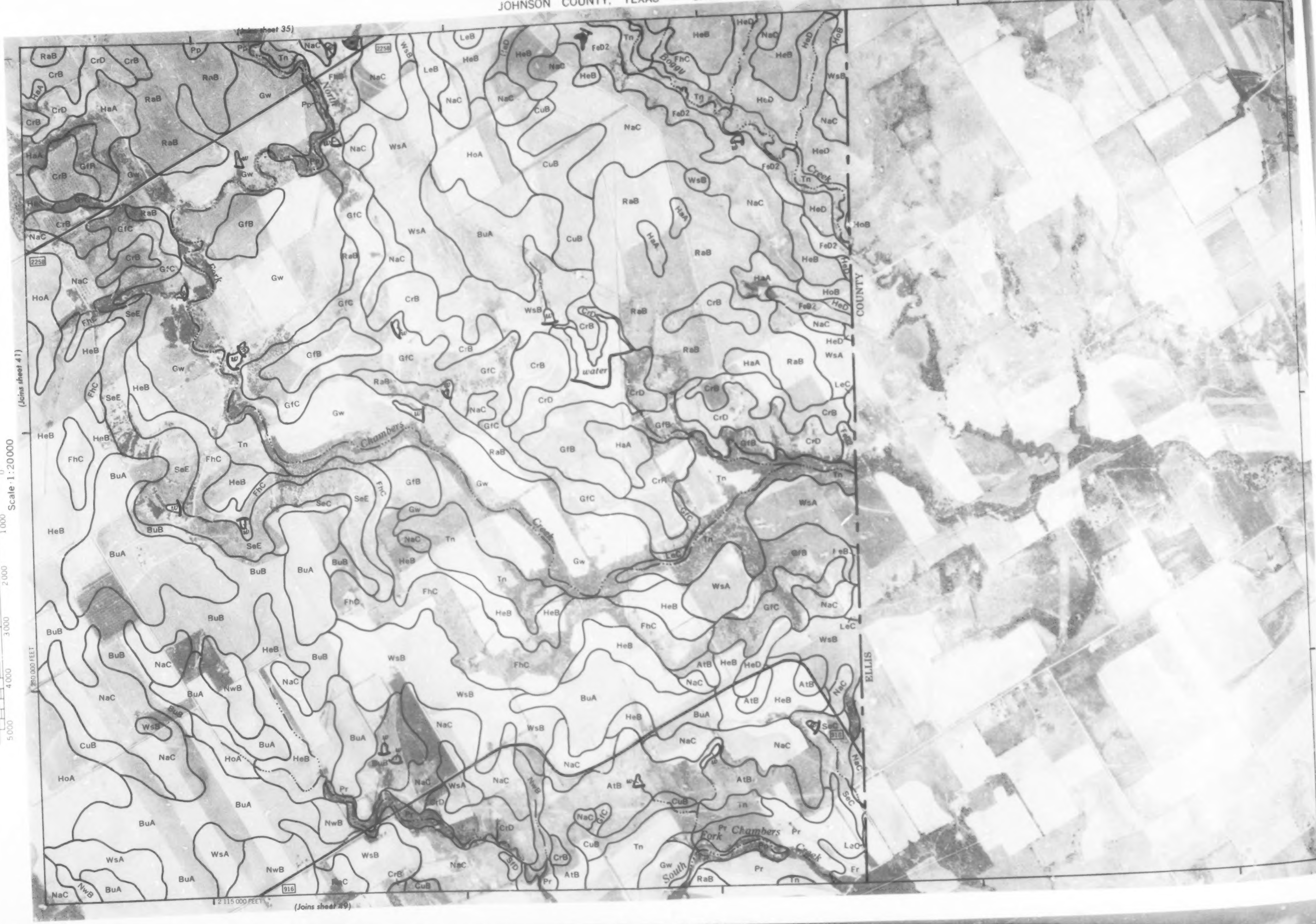
JOHNSON COUNTY, TEXAS — SHEET NUMBER 40


40
N
(Joins sheet 33)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 47)
2 065 000 FEET
230 000 FEET
1 Mile
5 000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
Sand Flat
110
Mustang Creek
North Fork
Middle Fork
Rock Creek
Tank Creek
SITE 57
SITE 59
SITE 61A
SITE 61

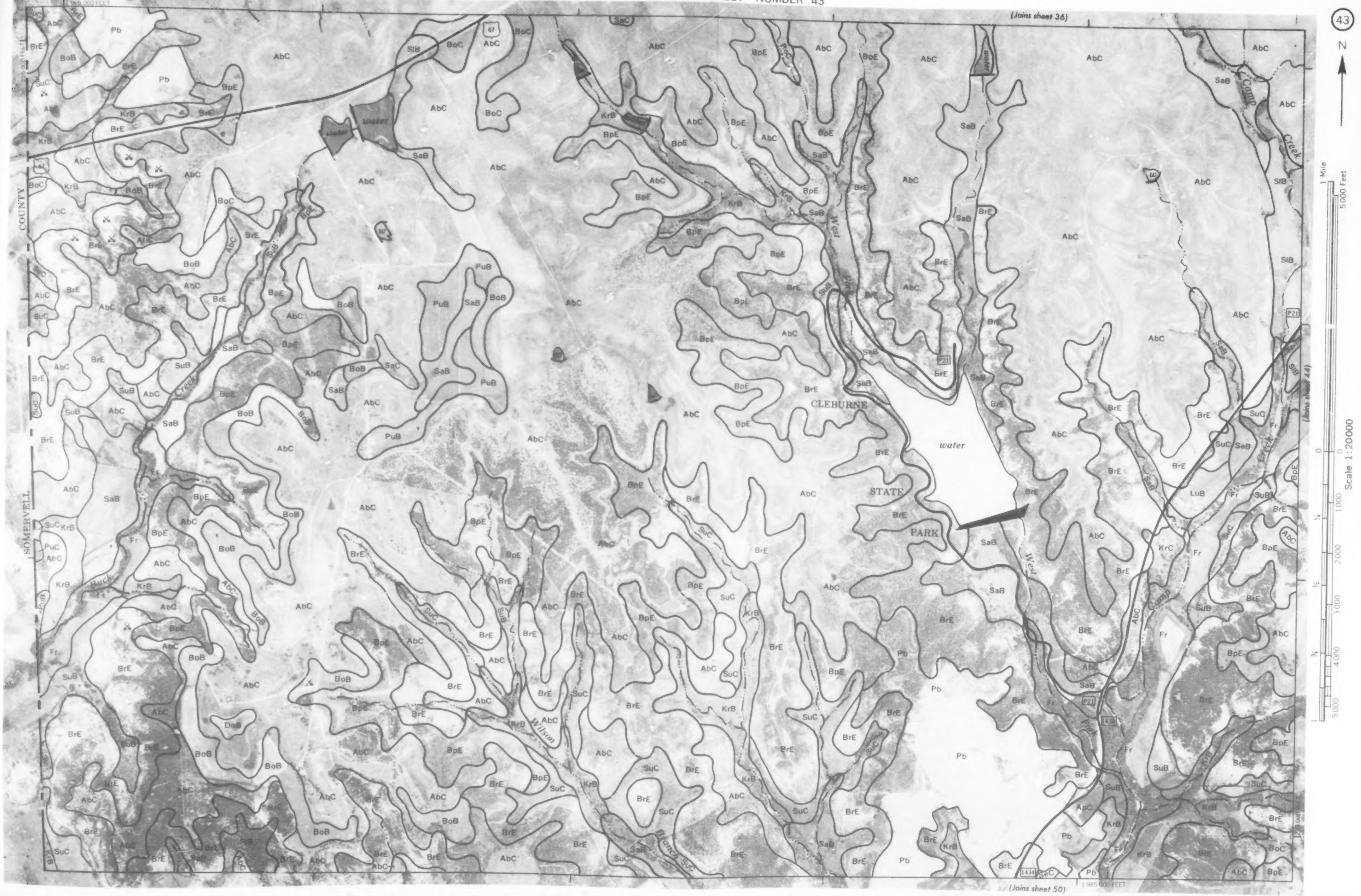
JOHNSON COUNTY, TEXAS — SHEET NUMBER 41


2 090 000 FEET
(Joins sheet 34)
240 000 FEET
(Joins sheet 40)
(Joins sheet 42)
230 000 FEET
(Joins sheet 48)
2 110 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
35W
81
2258
110
SITE 58
SITE 50
SITE 64A
Middle
Fork
Rock
Tank
Creek
South
Fork
Chambers
Creek
MISSOURI
KANSAS
TEXAS

JOHNSON COUNTY, TEXAS — SHEET NUMBER 42

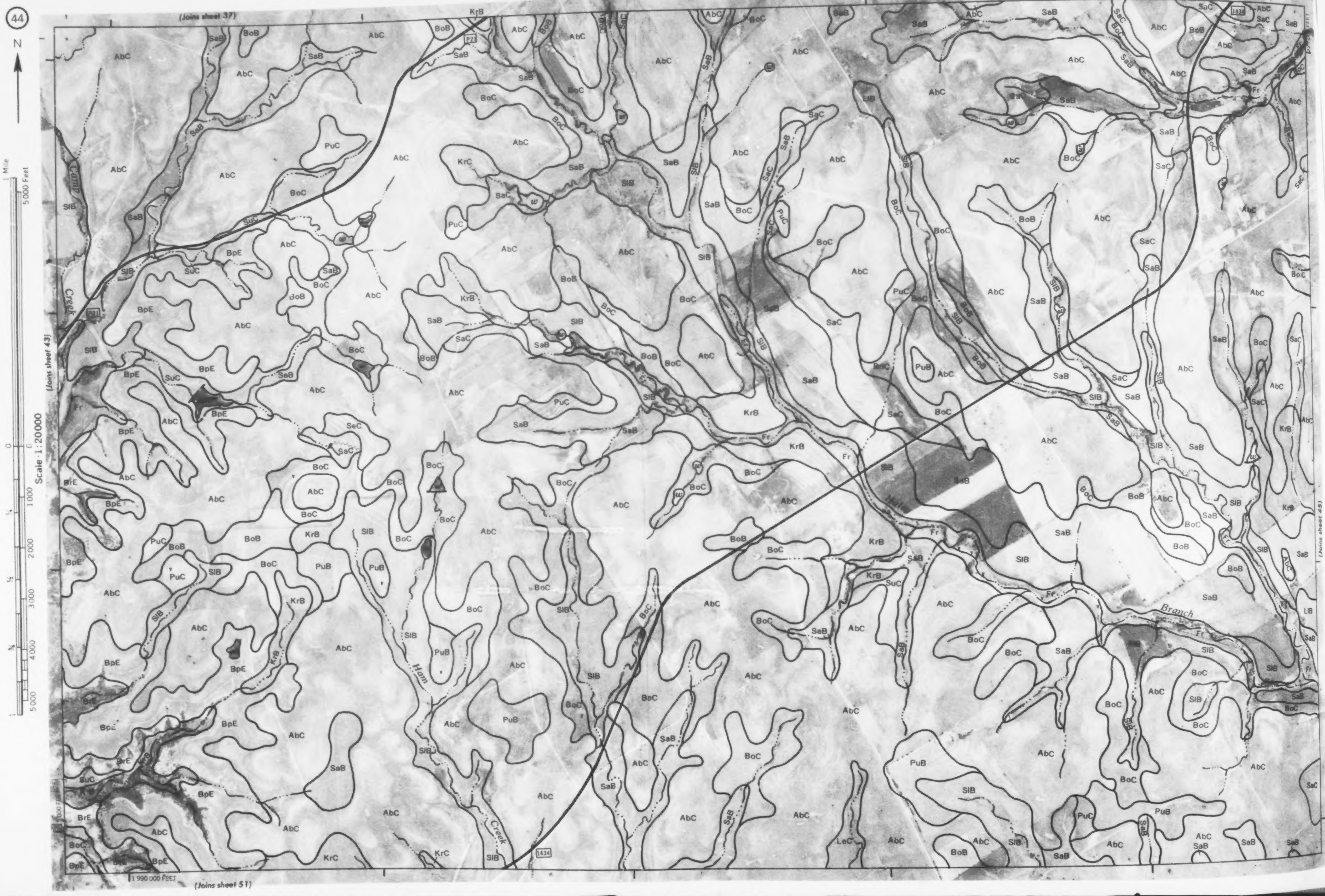

(Joins sheet 35)
(Joins sheet 41)
(Joins sheet 49)
Scale 1:20000
0
1000
2000
3000
4000
5000
2 115 000 FEET
2 135 000 FEET
ELLIS COUNTY
North Fork
Chambers Creek
Boggy Creek
South Fork Chambers Creek
water
2258
916
915

JOHNSON COUNTY, TEXAS — SHEET NUMBER 43

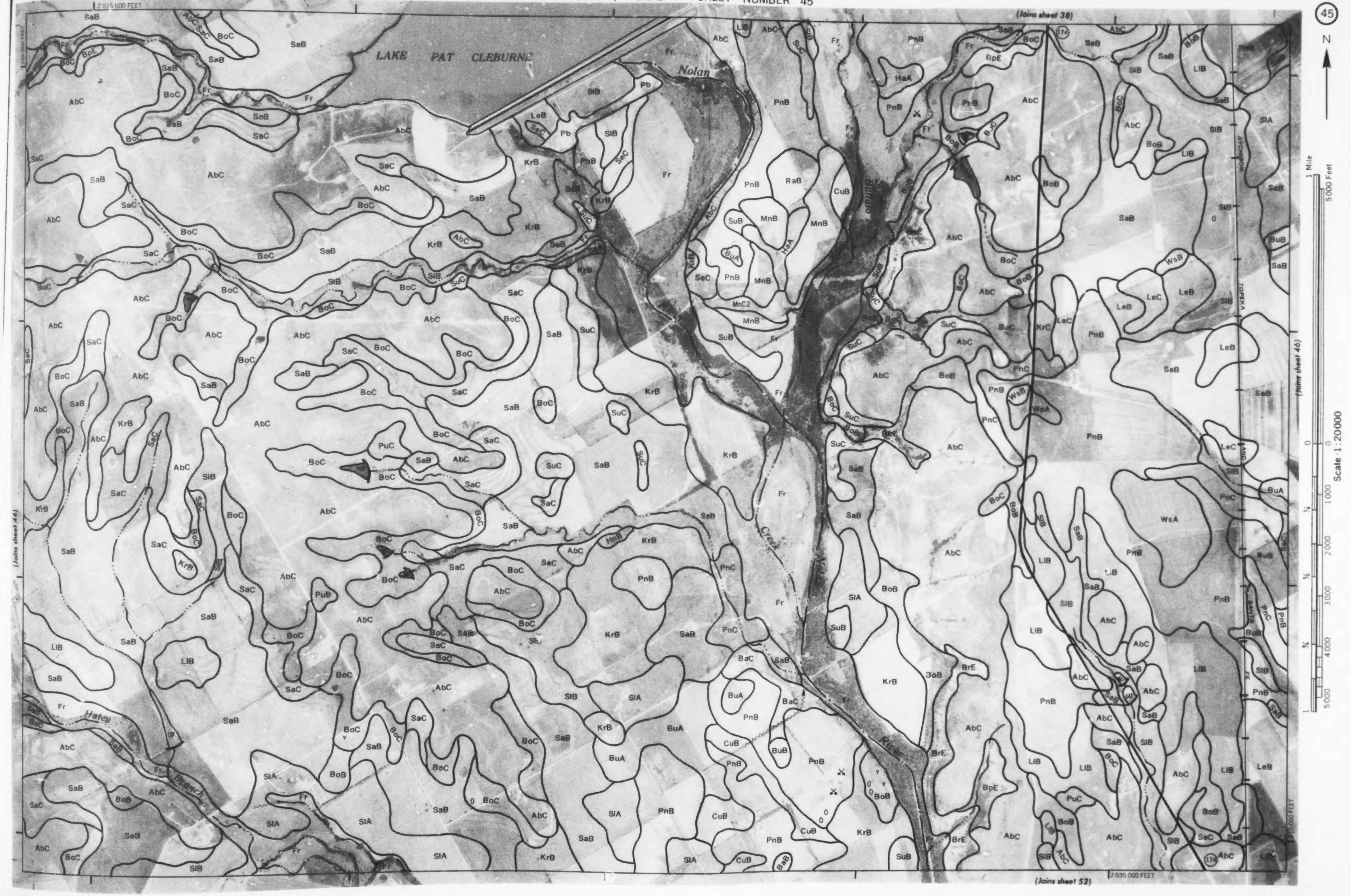


(Joins sheet 36)
(Joins sheet 44)
(Joins sheet 50)
43
N
SOMERVELL COUNTY
CLEBURNE
STATE
PARK
water
West Fork
Camp Creek
Buck Creek
Wilson Branch
67
P21
1434
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1 985 000 FEET
AbC
BoC
BoB
BpE
BrE
KrB
Pb
SaB
SaC
SuB
SuC
SlB
PuB
PuC
Fr
LuB
KrC
DoB
AbC

JOHNSON COUNTY, TEXAS — SHEET NUMBER 44

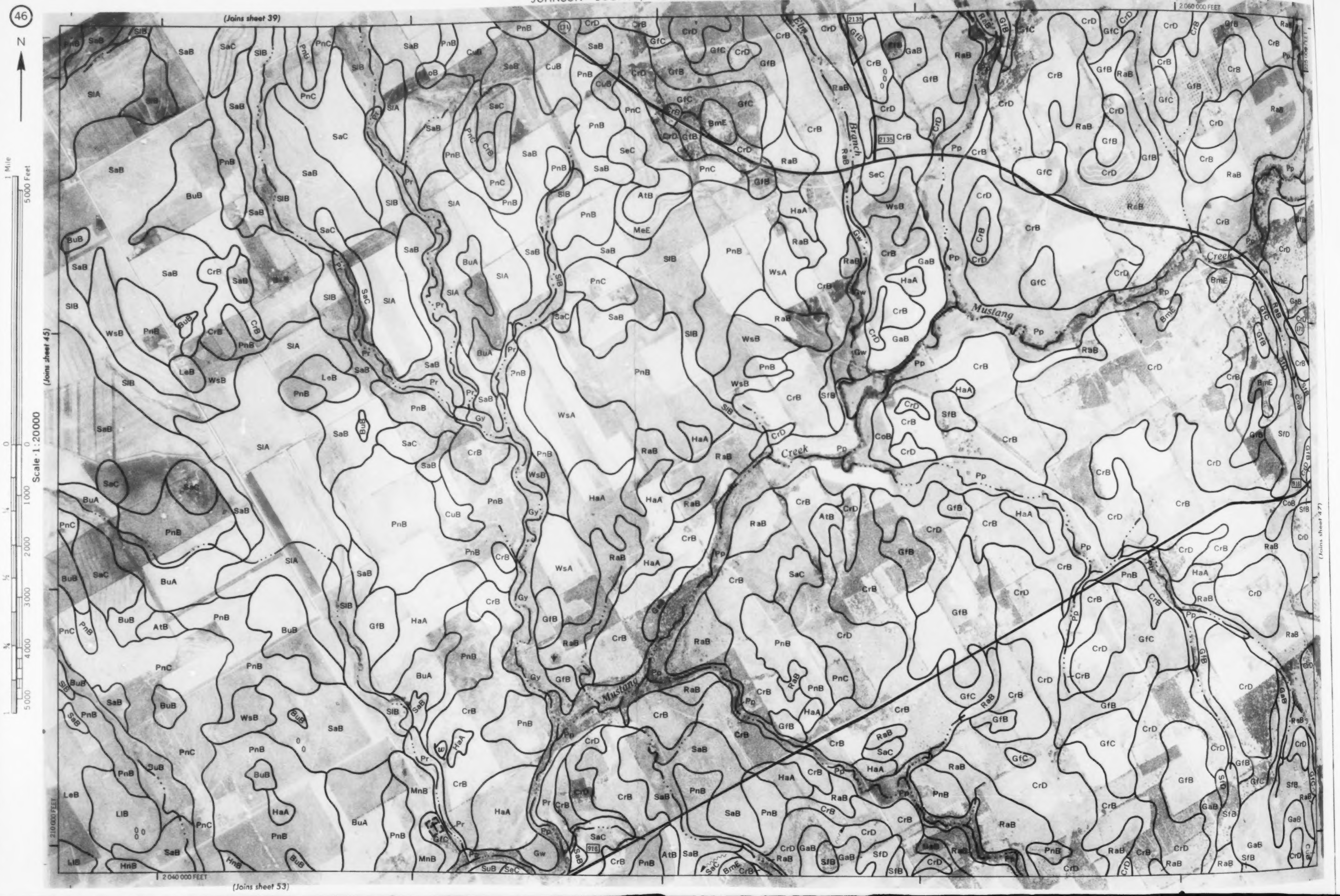

44
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 37)
(Joins sheet 43)
(Joins sheet 45)
(Joins sheet 51)
2 010 000 FEET
1 990 000 FEET
Camp Creek
Ham Creek
Branch
1434
921

JOHNSON COUNTY, TEXAS — SHEET NUMBER 45

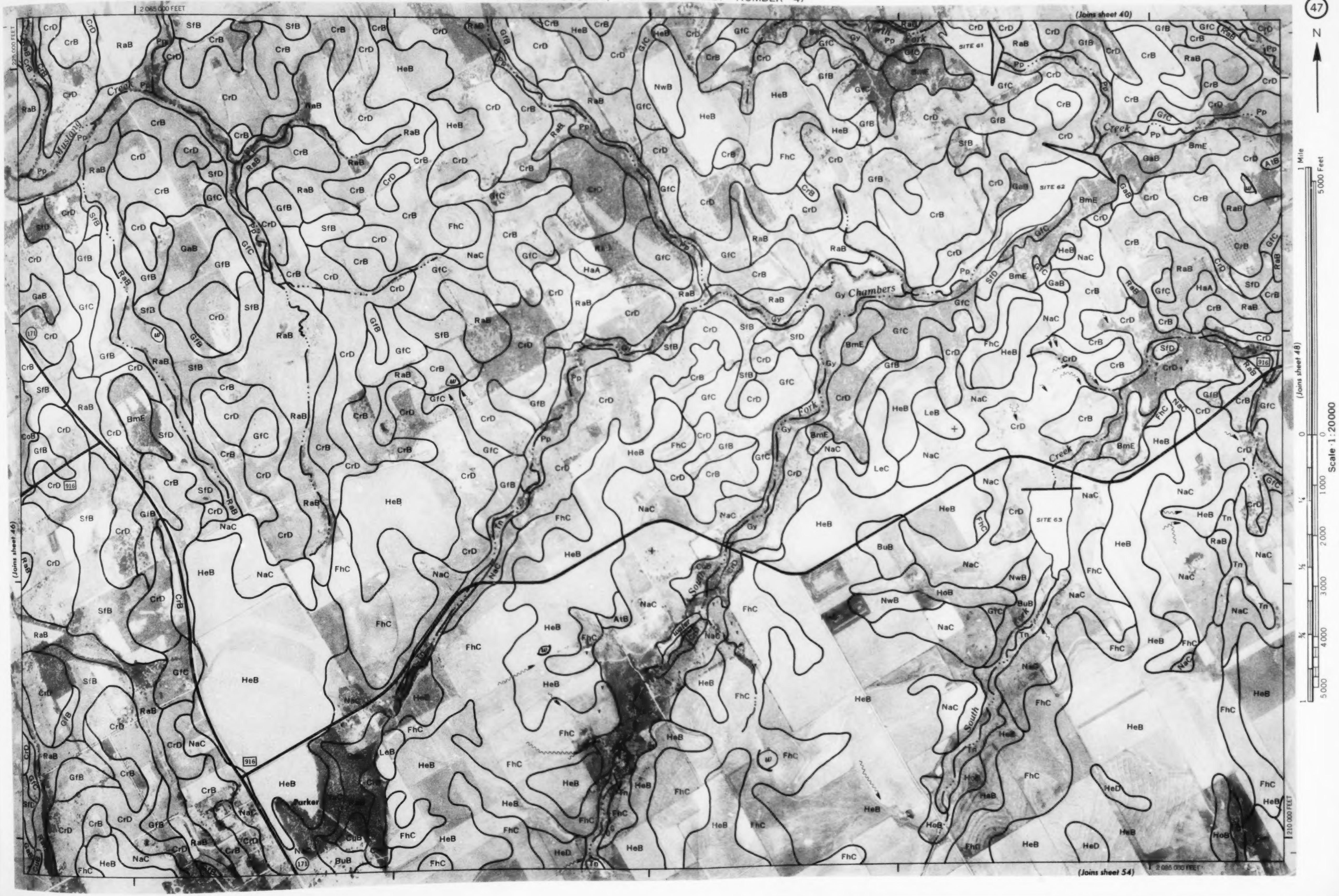

45
N
(Joins sheet 38)
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 52)
2 015 000 FEET
2 035 000 FEET
LAKE PAT CLEBURNE
Nolan
Buffalo
Creek
River
Haley
Branch
174
ATCHISON
TOPEKA
SANTA FE
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000

④⑥

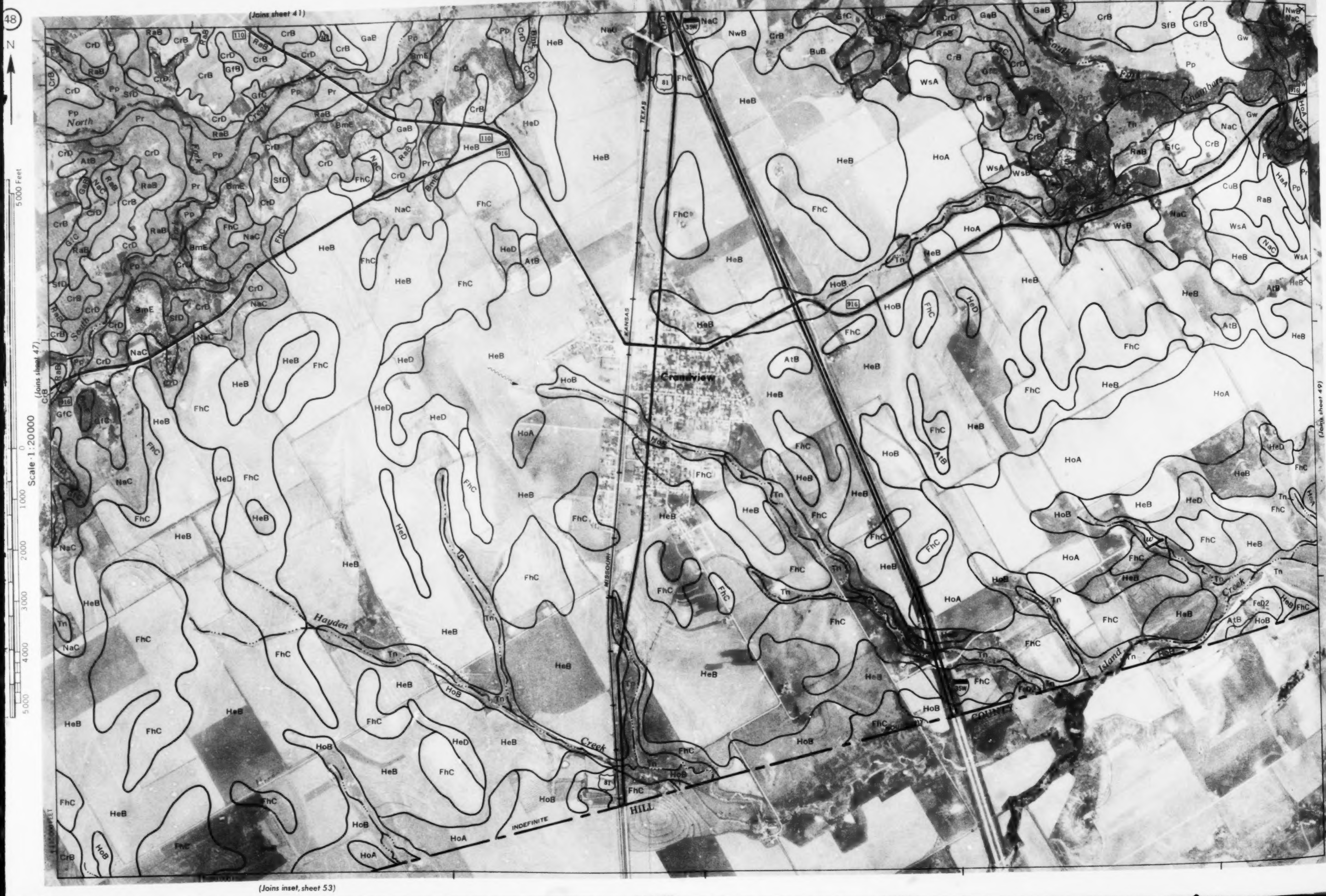
JOHNSON COUNTY, TEXAS — SHEET NUMBER 46


N
(Joins sheet 39)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 53)
2 060 000 FEET
2 040 000 FEET
210 000 FEET
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
½
¼
¾
Elm Branch
Mustang Creek
Creek
Mustang
171
2135
916
SaB
SlB
SlA
SaC
PnB
PnC
CuB
BuB
BuA
CrB
CrD
GfB
GfC
RaB
GaB
HaA
WsA
WsB
LeB
AtB
MeE
BmE
Pp
Pr
Gw
Gy
CoB
SfB
SfD
LlB
HnB
MnB
SuB
SeC

JOHNSON COUNTY, TEXAS — SHEET NUMBER 47

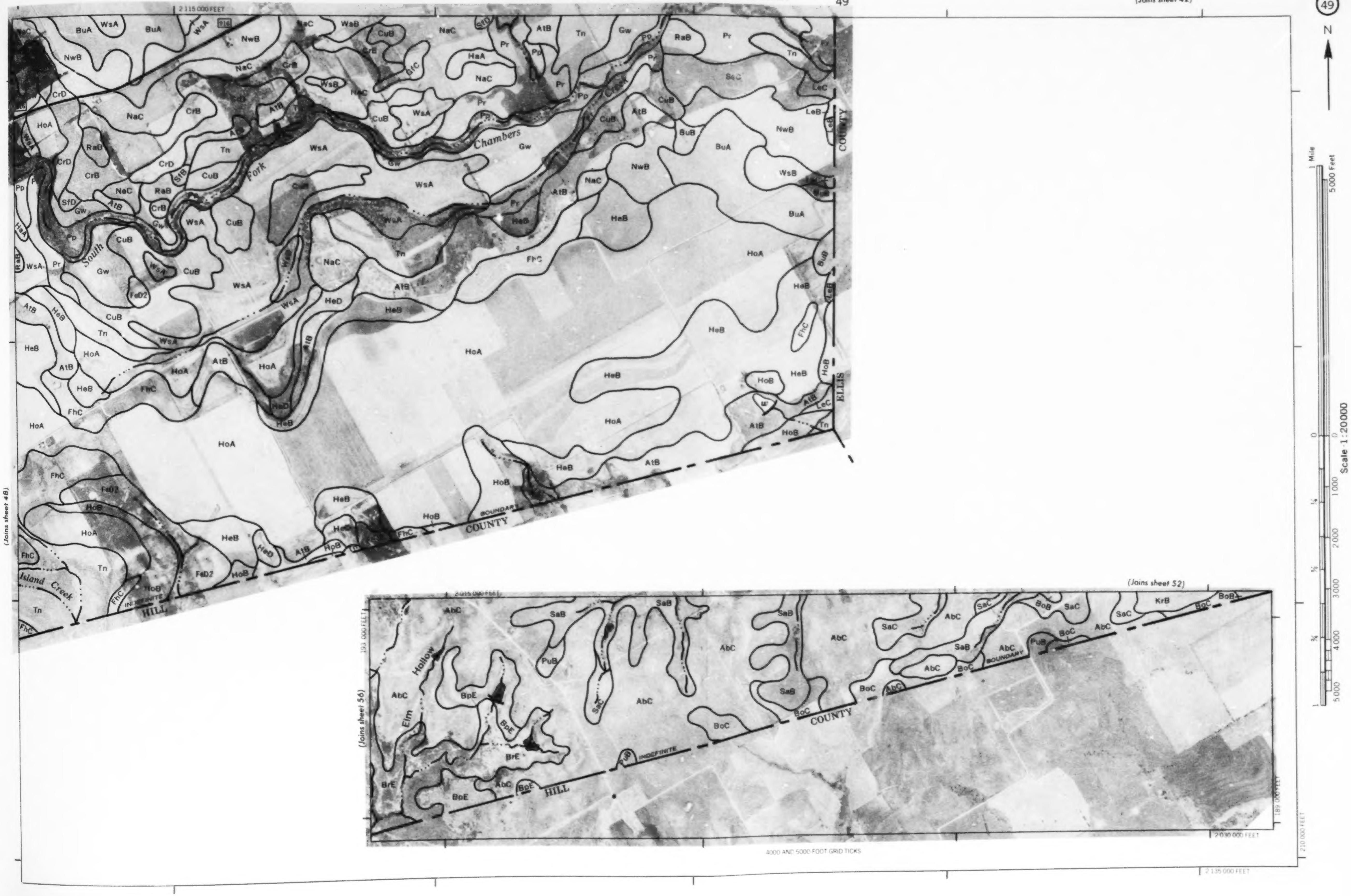

47
N
2 065 000 FEET
225 000 FEET
(Joins sheet 40)
(Joins sheet 46)
(Joins sheet 48)
(Joins sheet 54)
2 085 000 FEET
210 000 FEET
Mustang Creek
Chambers Creek
North Fork
Fork
South Fork
South
Parker
SITE 61
SITE 62
SITE 63
171
916
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
Scale 1:20000
CrB
CrD
RaB
SfB
SfD
GfB
GfC
GaB
HeB
HeD
FhC
NaC
NwB
BmE
Pp
Gy
Tn
LeB
LeC
BuB
HaA
AtB
CoB
ClB

JOHNSON COUNTY, TEXAS — SHEET NUMBER 48

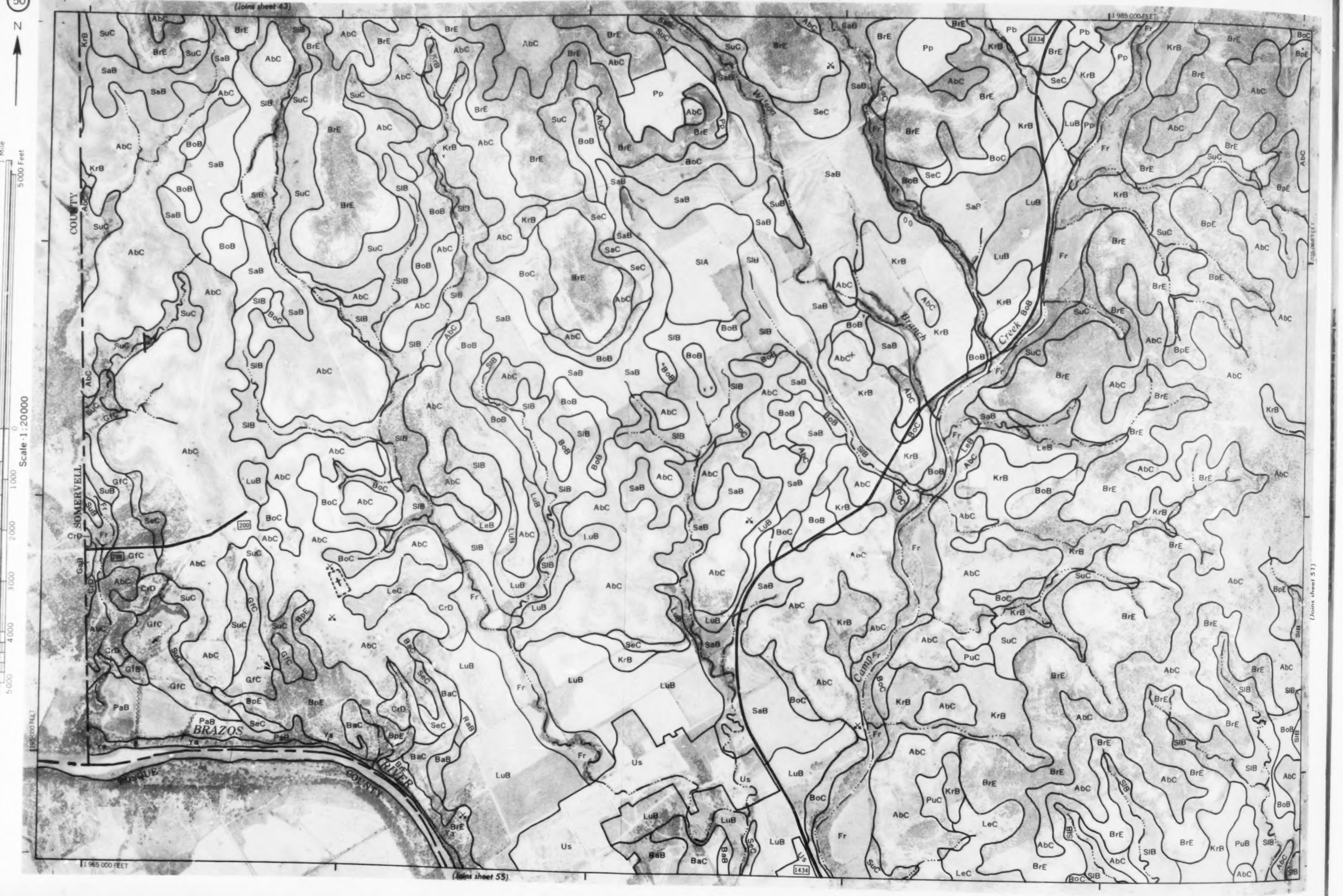

48
N
(Joins sheet 41)
(Joins sheet 47)
(Joins sheet 49)
(Joins inset, sheet 53)
Scale 1:20000
5000 Feet
0
1000
2000
3000
4000
5000
Grandview
North Fork Creek
South Fork
Chambers Creek
Hayden Creek
Island Creek
TEXAS
KANSAS
MISSOURI
INDEFINITE
HILL COUNTY
35W
81
110
916
HeB
FhC
HoA
HoB
HeD
Tn
AtB
CrB
CrD
NaC
Pp
Pr
RaB
SfD
SfB
GfC
GfB
GaB
BmE
BuB
NwB
WsA
WsB
CuB
HaA
Gw
FeD2

This map is compiled on 1973 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. [illegible] Coordinate grid ticks and land division corners, if shown, are approximately positioned.

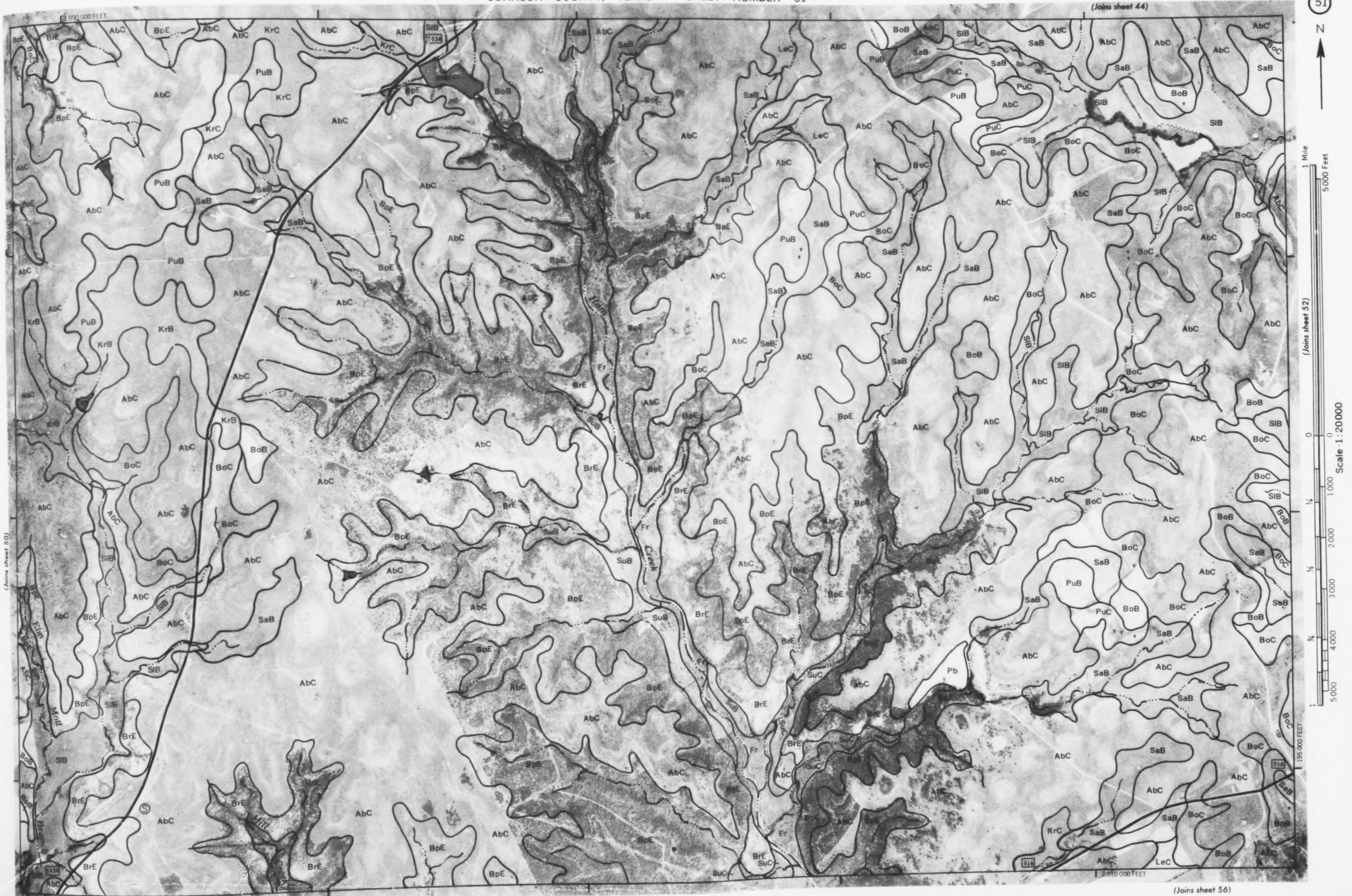
JOHNSON COUNTY, TEXAS — SHEET NUMBER 49


(Joins sheet 42)
49
N
2 115 000 FEET
South
Fork
Chambers
Creek
Island
Creek
ELLIS
COUNTY
HILL
COUNTY
BOUNDARY
INDEFINITE
(Joins sheet 48)
(Joins sheet 52)
(Joins sheet 56)
Elm
Hollow
193 000 FEET
2 015 000 FEET
189 000 FEET
2 030 000 FEET
210 000 FEET
2 135 000 FEET
4000 AND 5000 FOOT GRID TICKS
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
HoA
HeB
AtB
WsA
NaC
CuB
Tn
Gw
BuA
NwB
CrB
CrD
FhC
HoB
AbC
SaB
SaC
BoC
BpE
BrE
PuB
KrB
BoB

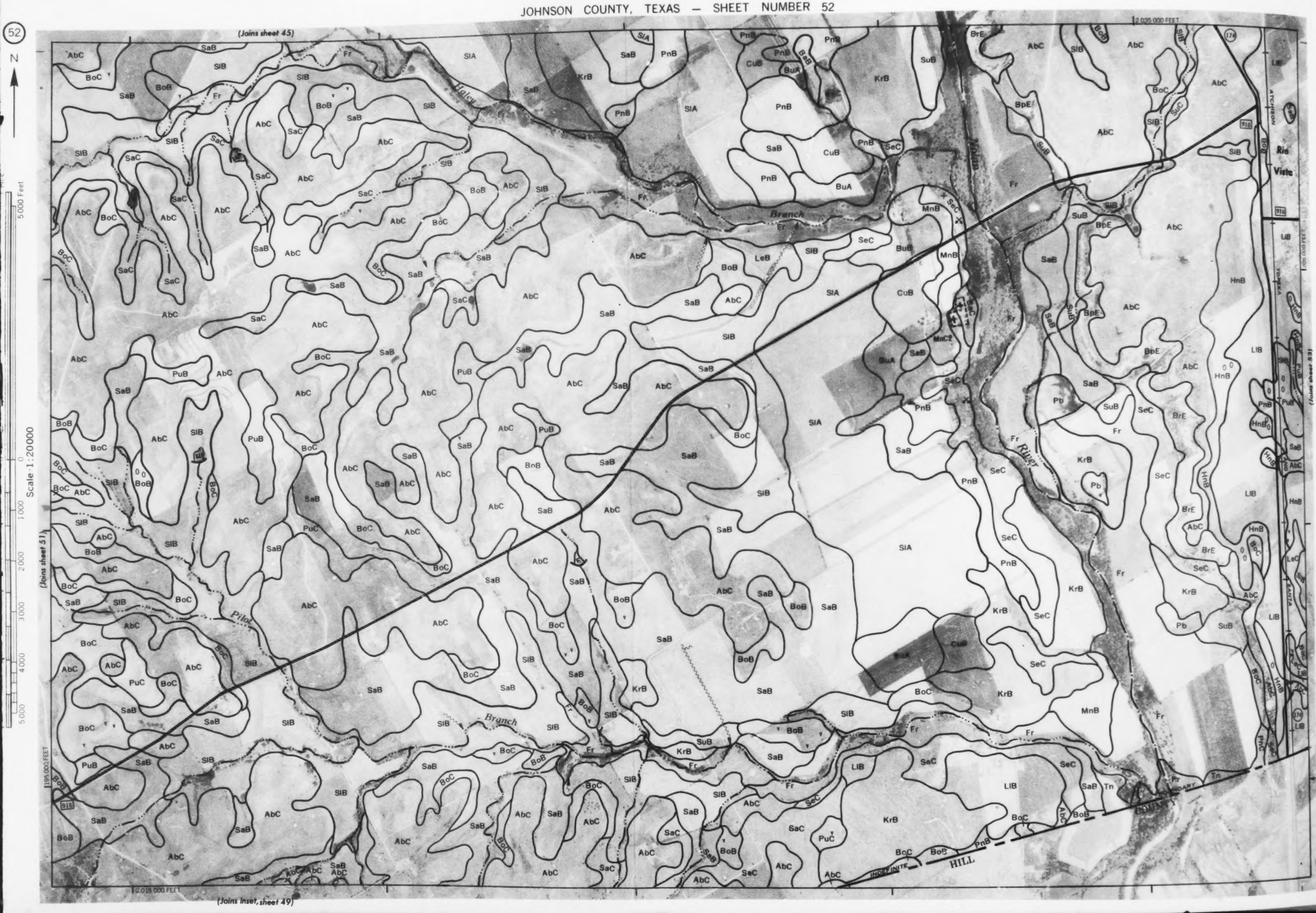
JOHNSON COUNTY, TEXAS — SHEET NUMBER 50


N
(Joins sheet 43)
(Joins sheet 55)
(Joins sheet 51)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
1 985 000 FEET
1 965 000 FEET
SOMERVELL COUNTY
BOSQUE COUNTY
BRAZOS RIVER
Wilson Branch
Camp Creek
1434
200

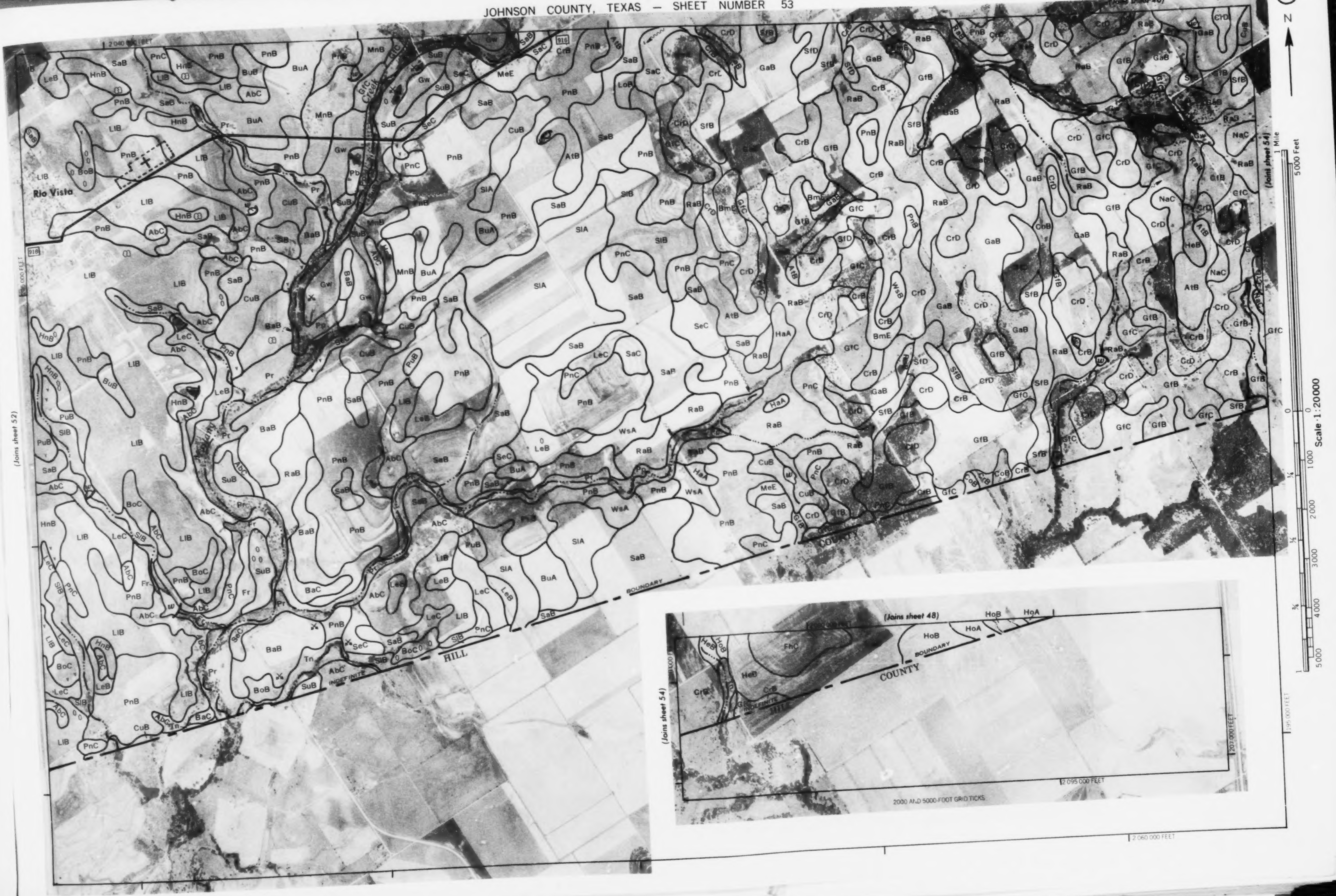
JOHNSON COUNTY, TEXAS — SHEET NUMBER 51


(Joins sheet 44)
(Joins sheet 52)
(Joins sheet 56)
(Joins sheet 50)
1 990 000 FEET
2 010 000 FEET
195 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Ham
Creek
Elm
Mott
Mill
Creek
1434
916
AbC
BoC
BpE
BrE
KrC
KrB
LeC
PuB
PuC
SaB
SlB
BoB
Fr
SuB
SuC
Pb

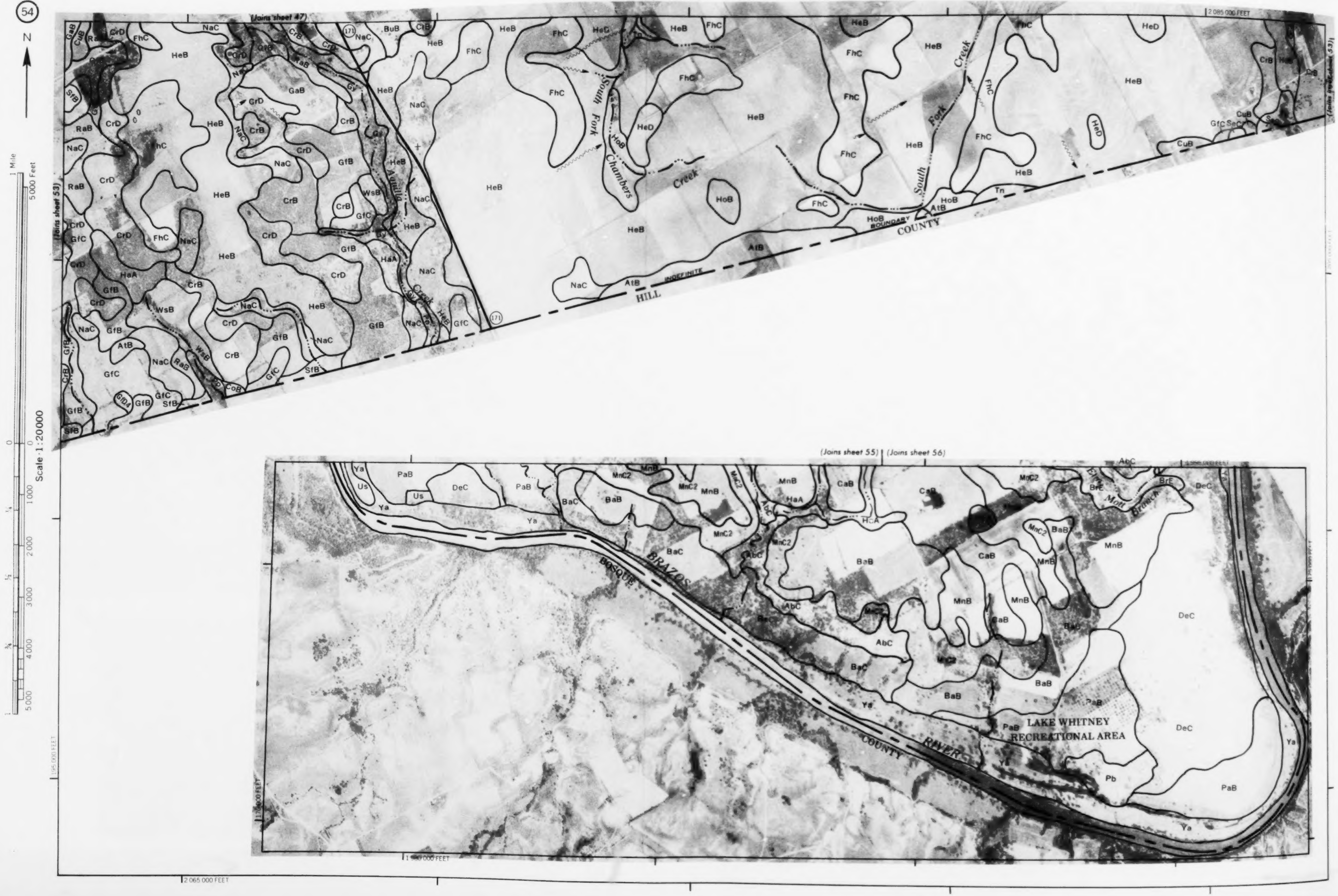
JOHNSON COUNTY, TEXAS — SHEET NUMBER 52

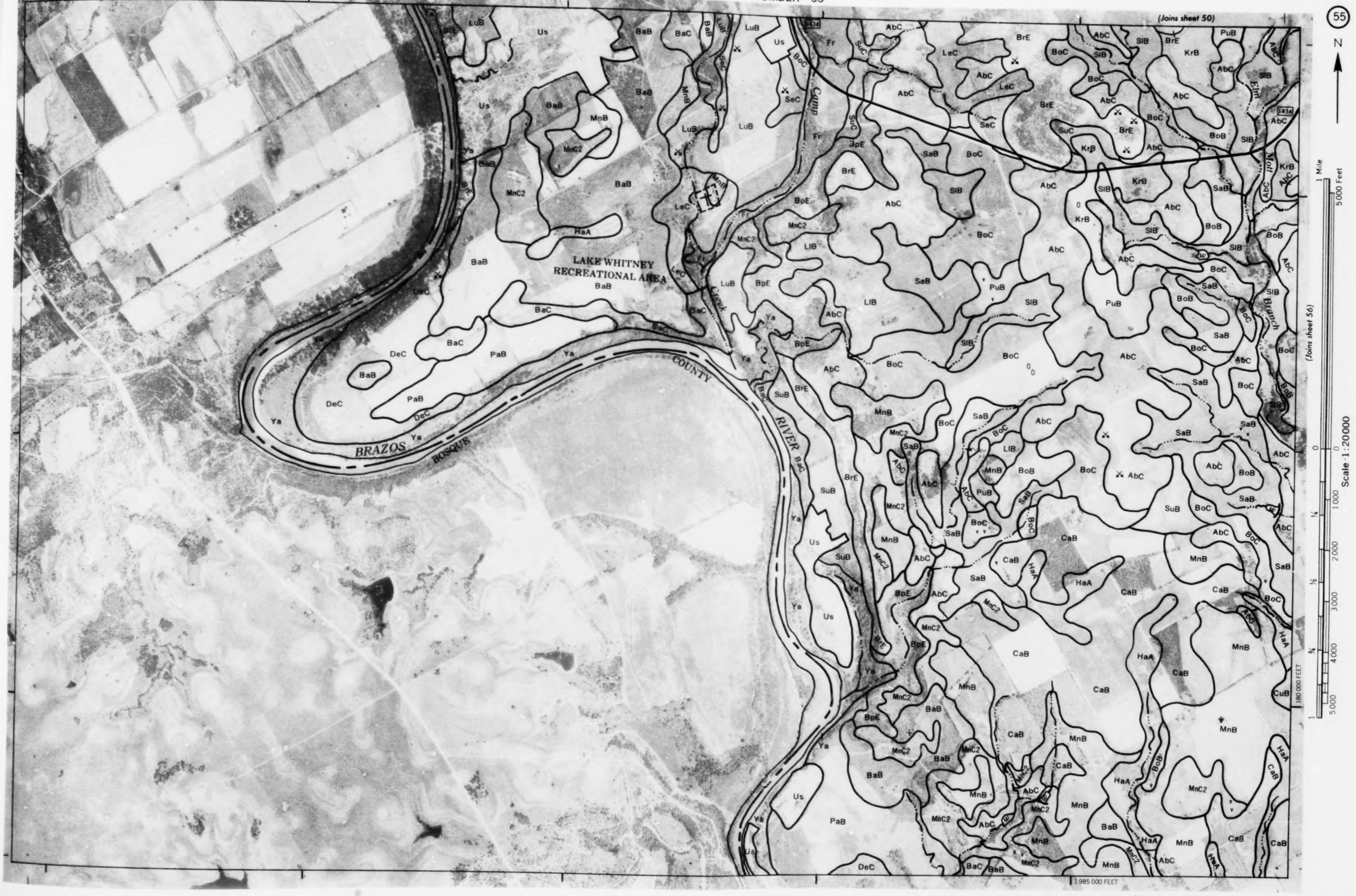

52
N
Scale 1:20000
5 000 Feet
0
1000
2000
3000
4000
5000
(Joins sheet 45)
(Joins sheet 51)
(Joins inset, sheet 49)
(Joins sheet 53)
2 025 000 FEET
2 015 000 FEET
195 000 FEET
Haley
Branch
Nolan
River
Pilot
Branch
Rio
Vista
916
174
ATCHISON
TOPEKA
SANTA FE
INDEFINITE
HILL
COUNTY
BOUNDARY
AbC
BoC
BoB
SaB
SaC
SlB
SlA
PuB
PuC
PnB
CuB
BuA
KrB
MnB
MnC2
SeC
Fr
LeB
BrE
BpE
SuB
SuC
HnB
LlB
Pb
Tn
LeC

JOHNSON COUNTY, TEXAS — SHEET NUMBER 53

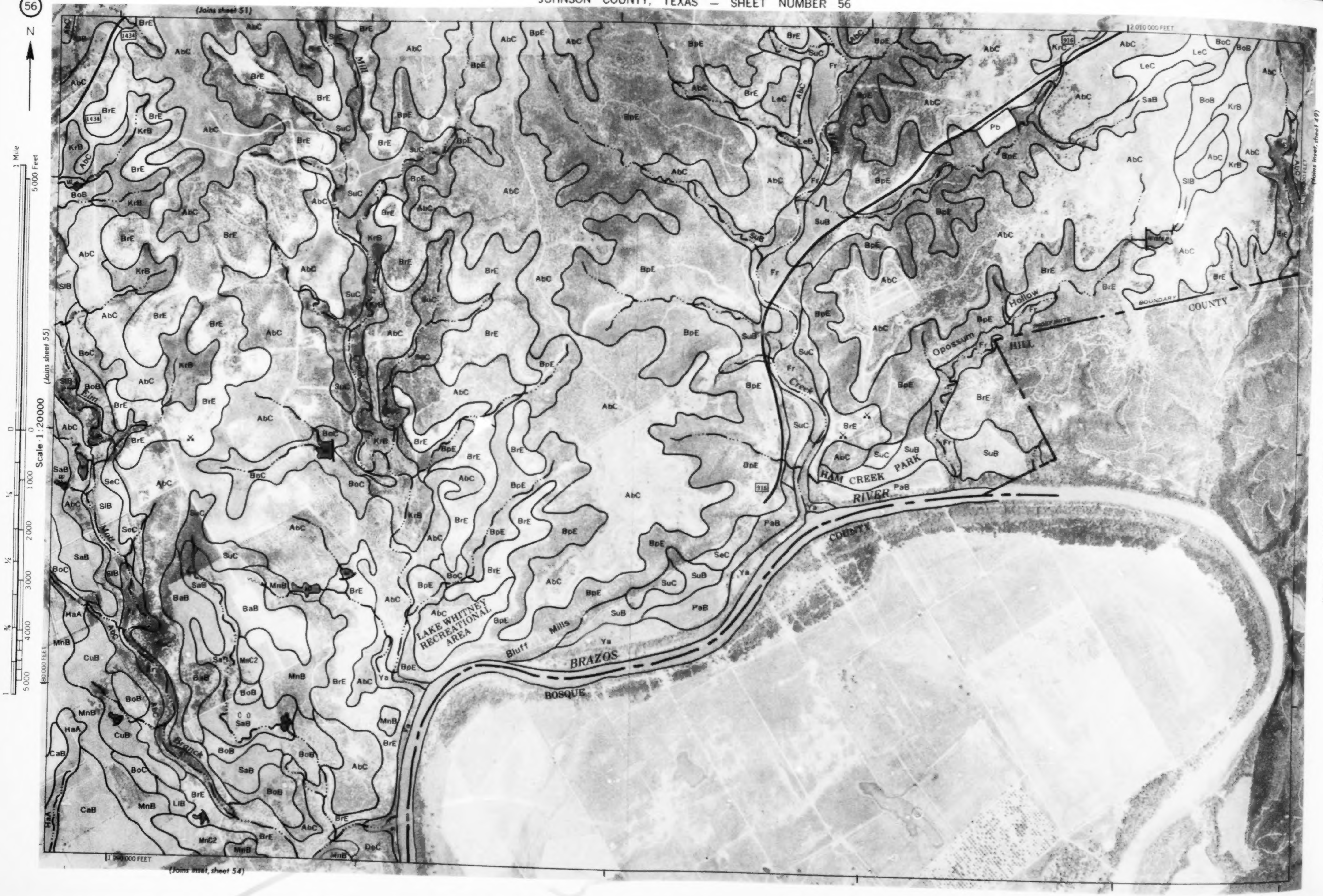

(Joins sheet 46)
(Joins sheet 52)
(Joins sheet 54)
(Joins sheet 48)
(Joins sheet 54)
N
Rio Vista
Creek
916
2 040 000 FEET
2 060 000 FEET
2 095 000 FEET
195 000 FEET
207 000 FEET
INDEFINITE HILL COUNTY BOUNDARY
2000 AND 5000-FOOT GRID TICKS
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
PnB
SaB
LlB
AbC
CrD
GfC
GfB
SfB
RaB
GaB
CrB
SlA
BaB
HoB
HoA
HeB
FhC

JOHNSON COUNTY, TEXAS — SHEET NUMBER 54


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 47)
(Joins sheet 53)
(Joins sheet 53)
2 085 000 FEET
2 065 000 FEET
195 000 FEET
170 000 FEET
1 980 000 FEET
171
South Fork
Chambers
Creek
South Fork
Creek
HILL
INDEFINITE
BOUNDARY
COUNTY
(Joins sheet 55)
(Joins sheet 56)
BOSQUE
BRAZOS
RIVER
COUNTY
Mott Branch
LAKE WHITNEY
RECREATIONAL AREA
HeB
FhC
NaC
CrD
CrB
GfB
GfC
GaB
RaB
HeD
HoB
AtB
Tn
WsB
SfB
CoB
CuB
HaA
BuB
Ya
Us
PaB
DeC
BaC
BaB
MnC2
MnB
CaB
AbC
HaA
BrE
Pb


55
(Joins sheet 50)
(Joins sheet 56)
(Joins inset sheet 54)
N
1 985 000 FEET
180 000 FEET
LAKE WHITNEY
RECREATIONAL AREA
BRAZOS
BOSQUE
COUNTY
RIVER
Camp
Creek
Elm
Moll
Branch
1434
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20000
AbC
BaB
BaC
BoB
BoC
BpE
BrE
CaB
CuB
DeC
Fr
HaA
KrB
LeC
LlB
LuB
MnB
MnC2
PaB
PuB
SaB
SeC
SlB
SuB
SuC
Us
Ya

JOHNSON COUNTY, TEXAS — SHEET NUMBER 56


N
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
(Joins sheet 51)
(Joins sheet 55)
(Joins inset, sheet 54)
(Joins inset, sheet 49)
2 010 000 FEET
1 990 000 FEET
80 000 FEET
1434
916
Mill
Elm
Mott
Branch
Opossum
Hollow
Creek
HILL
COUNTY
BOUNDARY
HAM CREEK PARK
LAKE WHITNEY RECREATIONAL AREA
Bluff
Mills
BRAZOS
RIVER
BOSQUE
COUNTY
AbC
BrE
BpE
SuC
SuB
KrB
BoB
BoC
SlB
SeC
SaB
BaB
MnB
MnC2
CuB
HaA
CaB
LiB
DeC
LeC
LeB
Fr
Pb
PaB
Ya